

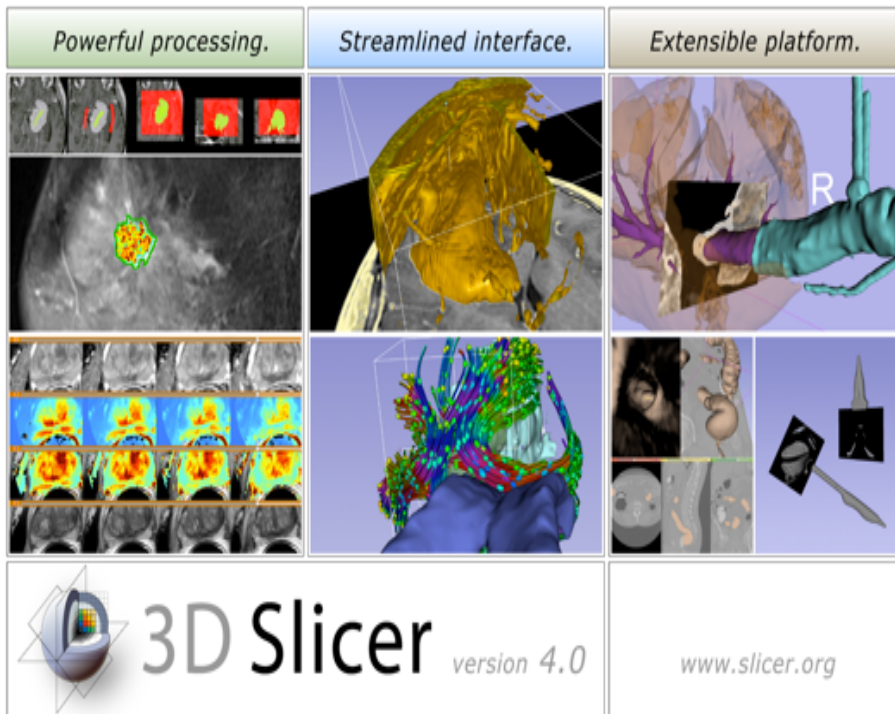


3D Data Loading and Visualization

Sonia Pujol, Ph.D.

Surgical Planning Laboratory
Harvard University

3DSlicer



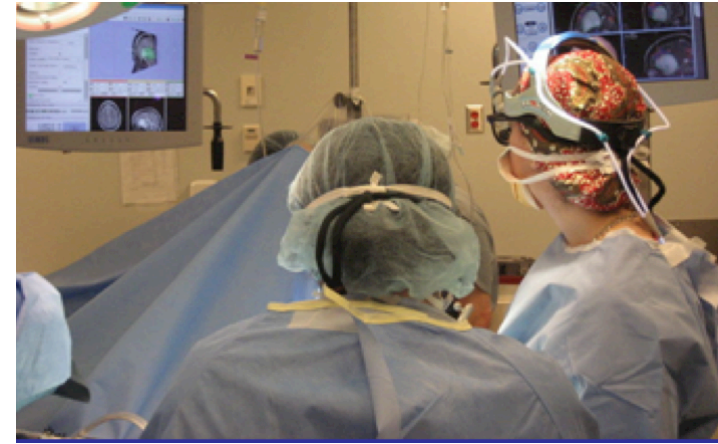
Slicer is a freely available [open-source](#) platform for segmentation, registration and 3D visualization of medical imaging data.

3DSlicer is a [multi-institutional effort](#) supported by the [National Institute of Health](#).

Translational research



An **open-source environment**
for software developers



An **end-user application**
for clinical investigators
and scientists

3D Slicer: an open-source platform for
translating innovative algorithms into
clinical research applications

3DSlicer History

- 1997: Slicer started as a research project between the Surgical Planning Lab (Harvard) and the CSAIL (MIT)

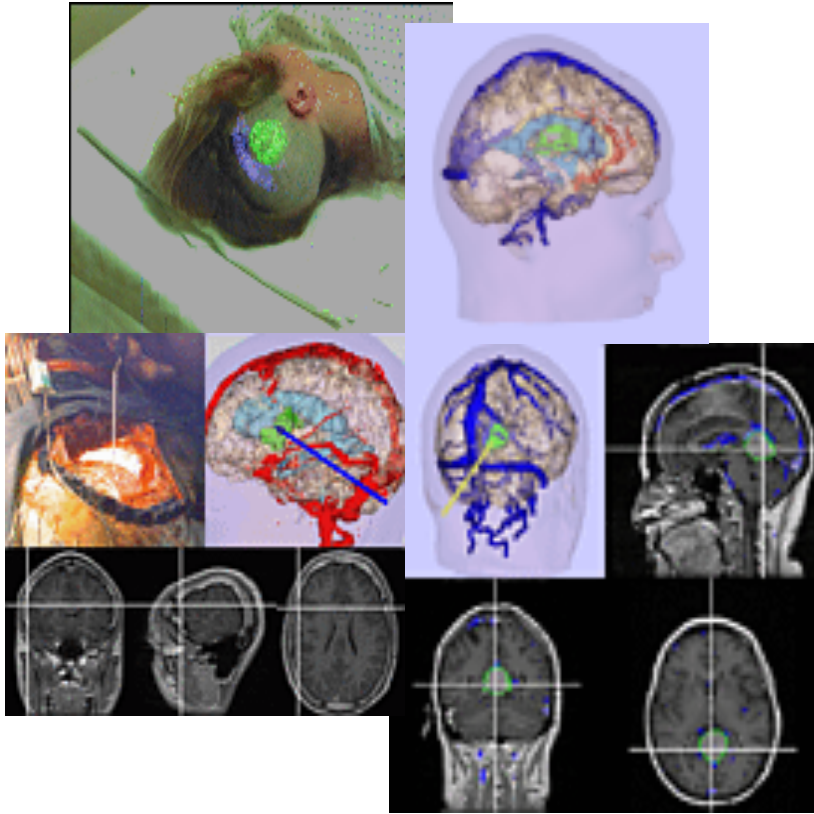
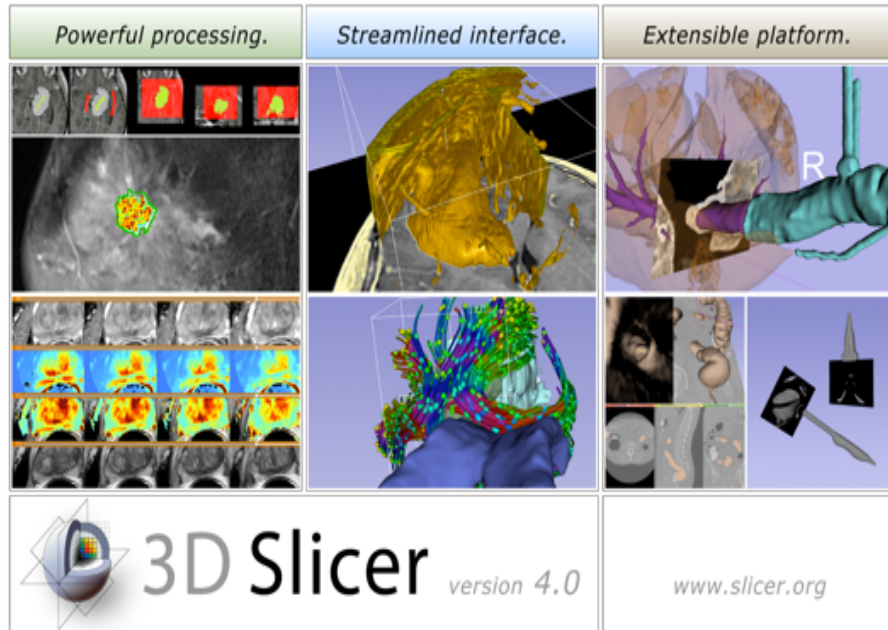


Image Courtesy of the CSAIL, MIT

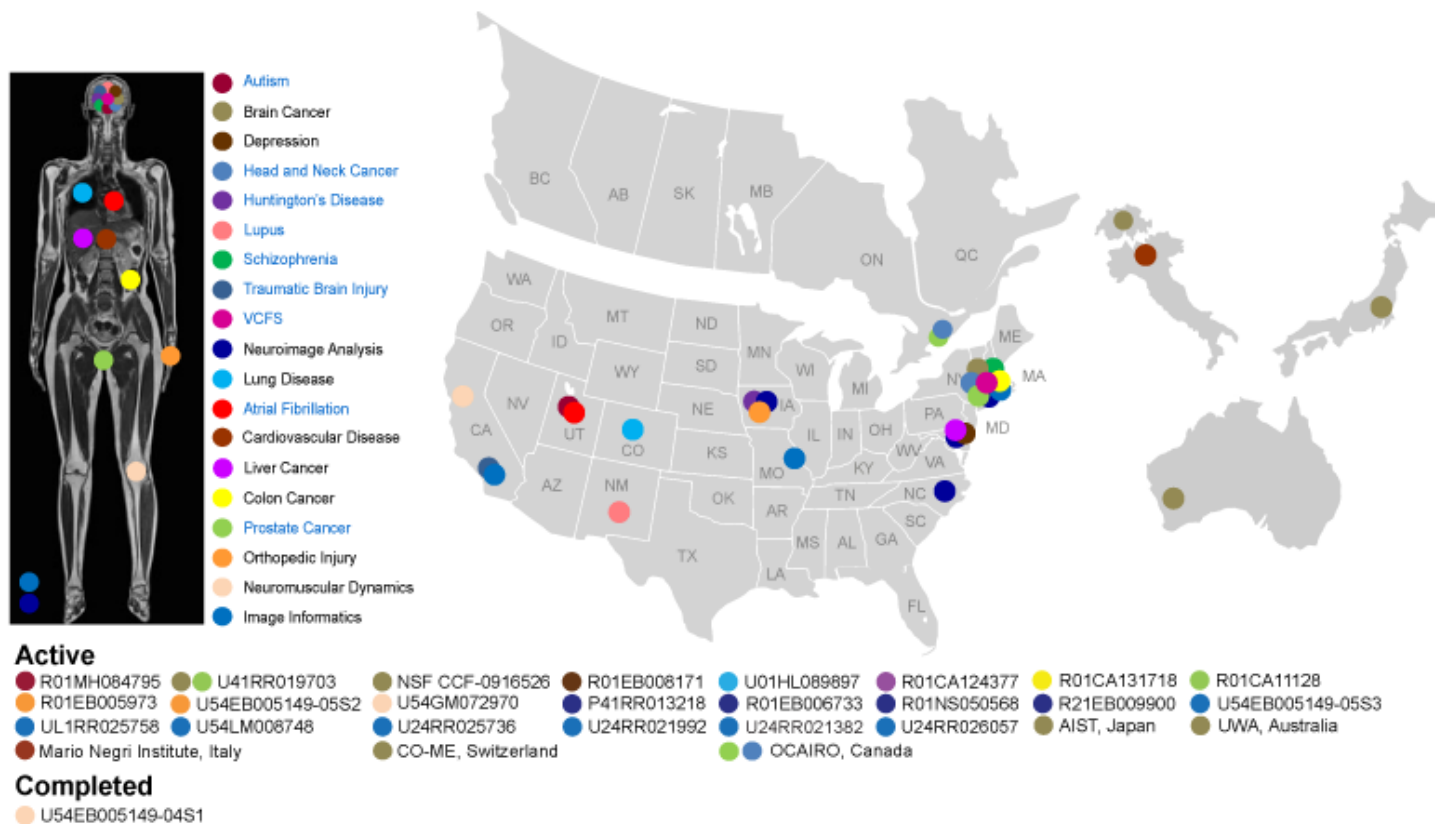
3DSlicer History

- 1997: Slicer started as a research project between the Surgical Planning Lab (Harvard) and the CSAIL (MIT)



2013: Multi-institution effort to share the latest advances in image analysis with clinicians and scientists

A Multi-institution Effort



- Infrastructure grants fund the platform
- Collaborative projects (e.g. Canada, Japan, Australia, Italy) fund the application packages

Slicer Is Open

- Open Science
= Open Source
+ Open Data
+ Open Community

Madrid 2012

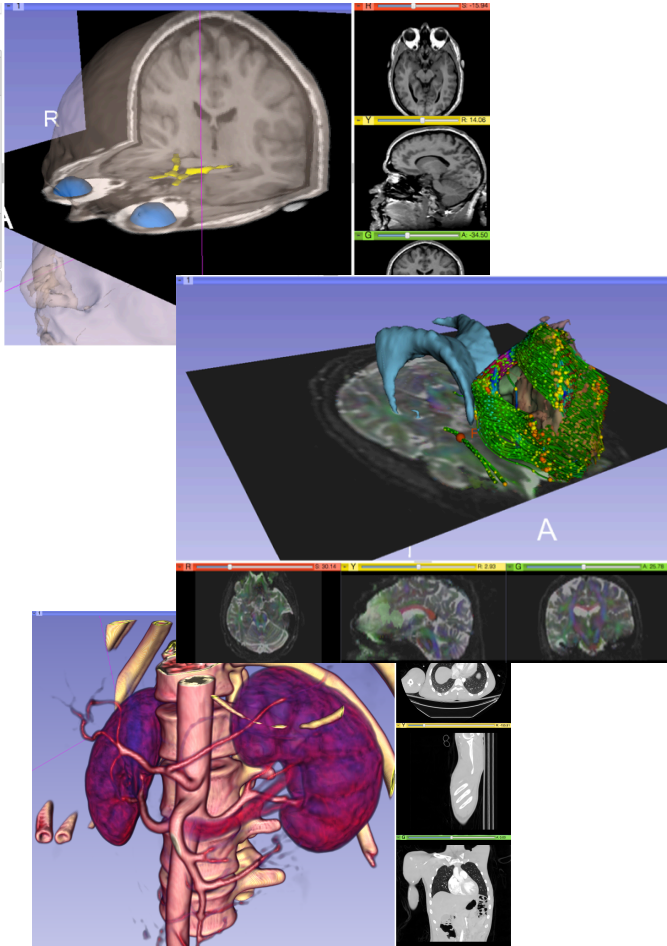


Iowa City, USA 2012



Courtesy R. Kikinis

Slicer Open Community



- 80 authorized developers contributing to the source code of Slicer
- Over 700 subscribers on Slicer user and Slicer developer mailing list

Nov.2011-March.2013

Downloads



Slicer 4 download statistics

Total matching
downloads:
62948

Date range:

forever

Release type:

any

Browser type:

desktop

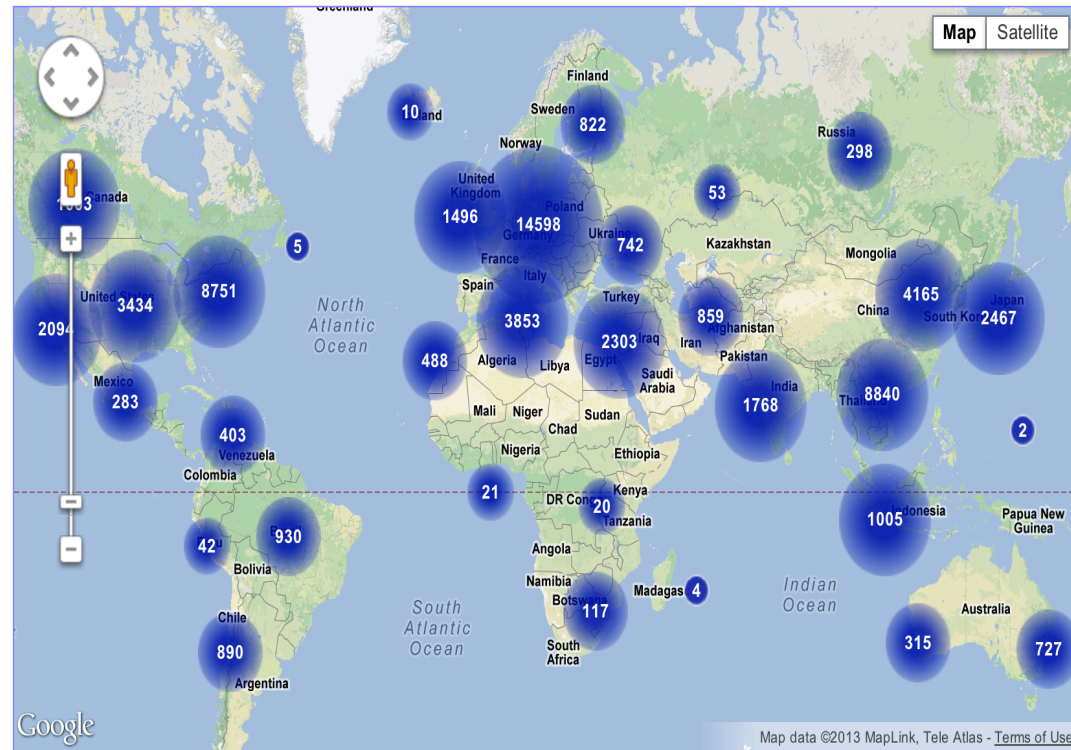
Update

Download location

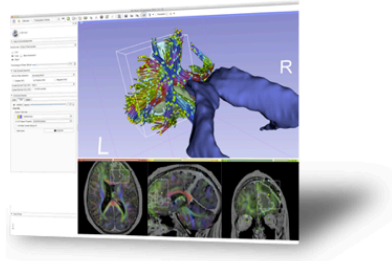
[By Country](#)

[By Filename](#)

[By Month](#)



3D Slicer in practice



Get Slicer 4.

Slicer 4 is the latest stable version of 3D Slicer, a free, comprehensive software platform for medical image analysis and visualization developed with NIH support.

3D Slicer is distributed under a permissive [BSD-style open source license](#). It has a thriving user and developer community.

Pre-compiled binaries

		Windows	Mac OS X	Linux
stable release	64 bit	4.1.0 64 bit installer 2012-04-11 r19886 (159.6MB)	4.1.0 64 bit installer 2012-04-11 r19886 (236.9MB)	4.1.0 64 bit archive 2012-04-11 r19886 (251.5MB)
	32 bit	4.1.0 32 bit installer 2012-04-11 r19886 (153.3MB)		
nightly build	64 bit	nightly 64 bit installer 2012-04-29 r19953 (160.4MB)	nightly 64 bit installer 2012-04-27 r19951 (237.4MB)	nightly 64 bit archive 2012-04-29 r19953 (252.0MB)
	32 bit	nightly 32 bit installer 2012-04-29 r19953 (154.0MB)		

System requirements

Slicer requires 1GB of RAM absolute minimum, with more highly recommended. Common data sets may require 4GB or more RAM for processing. A fast graphics card or GPU that supports OpenGL is also recommended.

Slicer is built and tested on many hardware and software platforms. 3D Slicer runs on Microsoft Windows XP, Vista, and Windows 7; Mac OS X versions 10.5 (Leopard), 10.6 (Snow Leopard), and 10.7 (Lion); and a variety of Linux distributions.

- Slicer is open-source
- Slicer works on Windows, Linux, and Mac
- Slicer is distributed under a BSD-style license agreement with no restriction on use

Slicer: Behind the scenes

Safari File Edit View History Bookmarks Window Help

CDash - Slicer4

http://www.cdash.org/slicer4/index.php?project=Slicer4

namic Google weather Slicer Countway Yahoo! eCommons dti_review

RSNA 2011 - NAMIC CDash - Slicer4

login All Dashboards

Monday, November 28, 2011 12:06:42 EST

Slicer4

Dashboard Calendar Previous Current Project

WARNING: This CDash instance is running the bleeding edge svn trunk CDash code, and is updated frequently. You have been warned.

File changed by 1 author as of Sunday, November 27 2011 - 22:00 EST

Lightly-Packages

Site	Build Name	Update	Configure			Build			Test			Build Time
		Files	Error	Warn	Error	Warn	Not Run	Fail	Pass			
stony-win7.kitware	Windows7-VS2010-32bits-QT4.7.1-PythonQt-With-Tcl-CLI-Release	0	0	0	2 ⁻² ₋₂	107	0	0	0			47 minutes ago
stony-mac-64bits.kitware	SnowLeopard-g++4.2.1-64bits-QT4.7-PythonQt-With-Tcl-CLI-Release	1	0	0	0	14 ⁻³ ₋₃	0	28 ⁻¹ ₋₁	459 ⁻¹ ₋₁			9 hours ago
stony-ubuntu-64bits.kitware	Linux-g++4.4.3-64bits-QT4.7-PythonQt-With-Tcl-CLI-Release	1	0	0	0	13 ⁻² ₋₄	0	28 ⁻¹ ₋₁₈	459 ⁻¹ ₋₁			13 hours ago
stony-win7.kitware	Windows7-VS2008-64bits-QT4.7.1-PythonQt-With-Tcl-CLI-Release	0	0	0	0 ⁻² ₋₂	1000 ⁻² ₋₂₃	0	26 ⁻² ₋₂	461 ⁻² ₋₂			4 hours ago
stony-win7.kitware	Windows7-VS2008-32bits-QT4.7.1-PythonQt-With-Tcl-CLI-Release	1	0	0	0 ⁻¹ ₋₁	1000 ⁻² ₋₂₃	0	24 ⁻² ₋₂	463 ⁻² ₋₂			11 hours ago

Lightly

Site	Build Name	Update	Configure			Build			Test			Build Time
		Files	Error	Warn	Error	Warn	Not Run	Fail	Pass			
itecube.kitware	SnowLeopard-gcc4.2.1-QT4.7.0-PythonQt-With-Tcl-Release	1	0	0	27	190	0	96	391			11 hours ago
upl.sci.utah.edu	OpenSuse-c++4.5.0-64bits-QT4.6.3-PythonQt-With-Tcl-NoCLI-Release	0	0	0	0	15	0	304	6			11 hours ago
s.kitware	Linux-g++4.4-QT4.6.3-PythonQt-CLI-Release	1	0	0	0	15 ⁻² ₋₂	0	36 ⁻² ₋₇	451 ⁻¹ ₋₁			3 hours ago
stony-ubuntu-64bits.kitware	Linux-g++4.4.3-QT4.7-PythonQt-With-Tcl-CLI-Valgrind-Release	0	0	0	0	13 ⁻² ₋₃	0	27 ⁻¹ ₋₄	460 ⁻¹ ₋₁			11 hours ago
stony-ubuntu-64bits.kitware	Linux-g++4.4.3-64bits-QT4.7-PythonQt-With-Tcl-NoCLI-Coverage-Release	0	0	0	0	12 ⁻² ₋₁	0	23 ⁻¹ ₋₁	287 ⁻¹ ₋₁			11 hours ago
garmatha.kitware	Linux-g++4.3.3-QT4.7-PythonQt-With-Tcl-NoCLI-Release	0	0	0	0	12 ⁻² ₋₂	0	22	288			12 hours ago

Continuous

Site	Build Name	Update	Configure			Build			Test			Build Time
		Files	Error	Warn	Error	Warn	Not Run	Fail	Pass			
upl.sci.utah.edu	OpenSuse-c++4.5.0-64bits-QT4.6.3-PythonQt-With-Tcl-NoCLI-Release	2	0	0	0	0 ⁻¹ ₋₁	0	304	6			1 hour ago

Slicer is built every night on Windows, Mac and Linux platforms

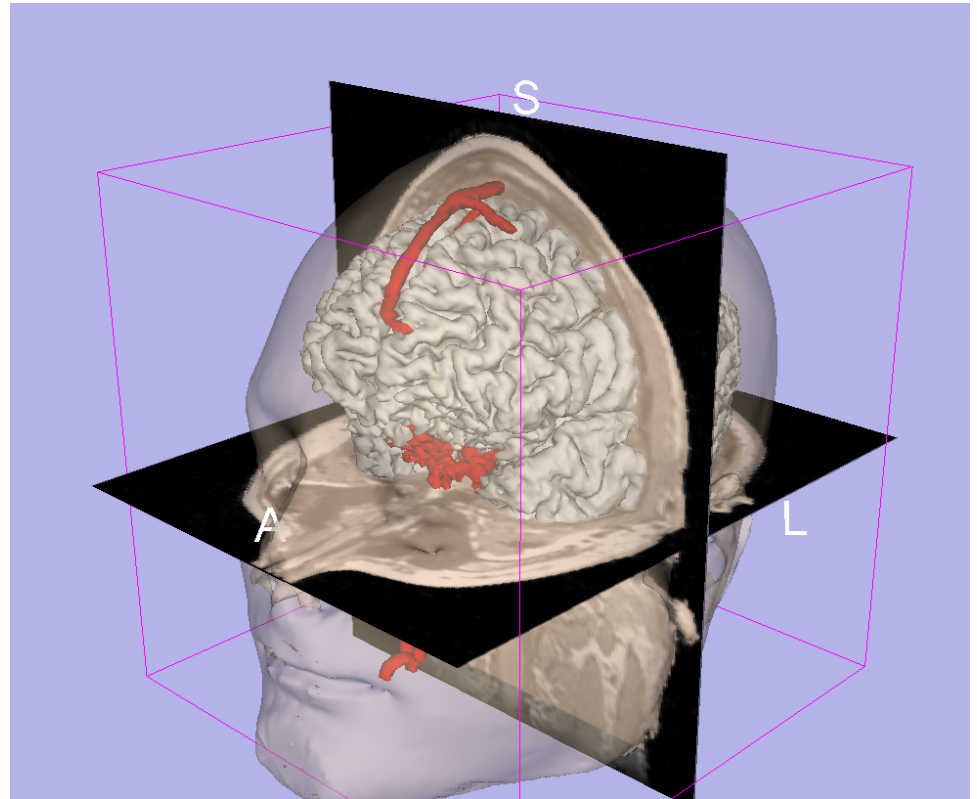
Slicer Training



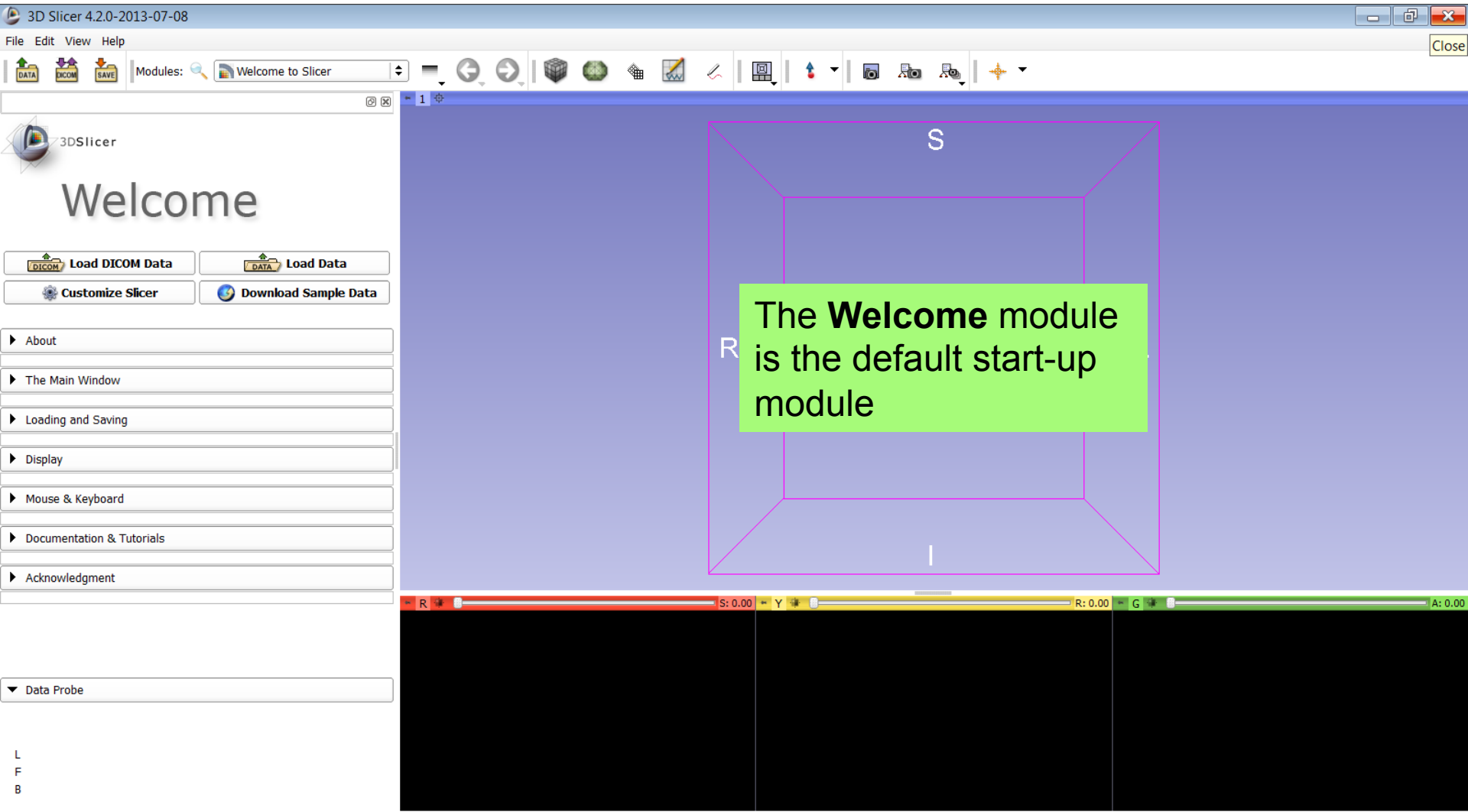
- Hands-on training workshops at national and international venues
- >2,300 clinicians, clinical researchers and scientists trained since 2005

3D Visualization of the Anatomy

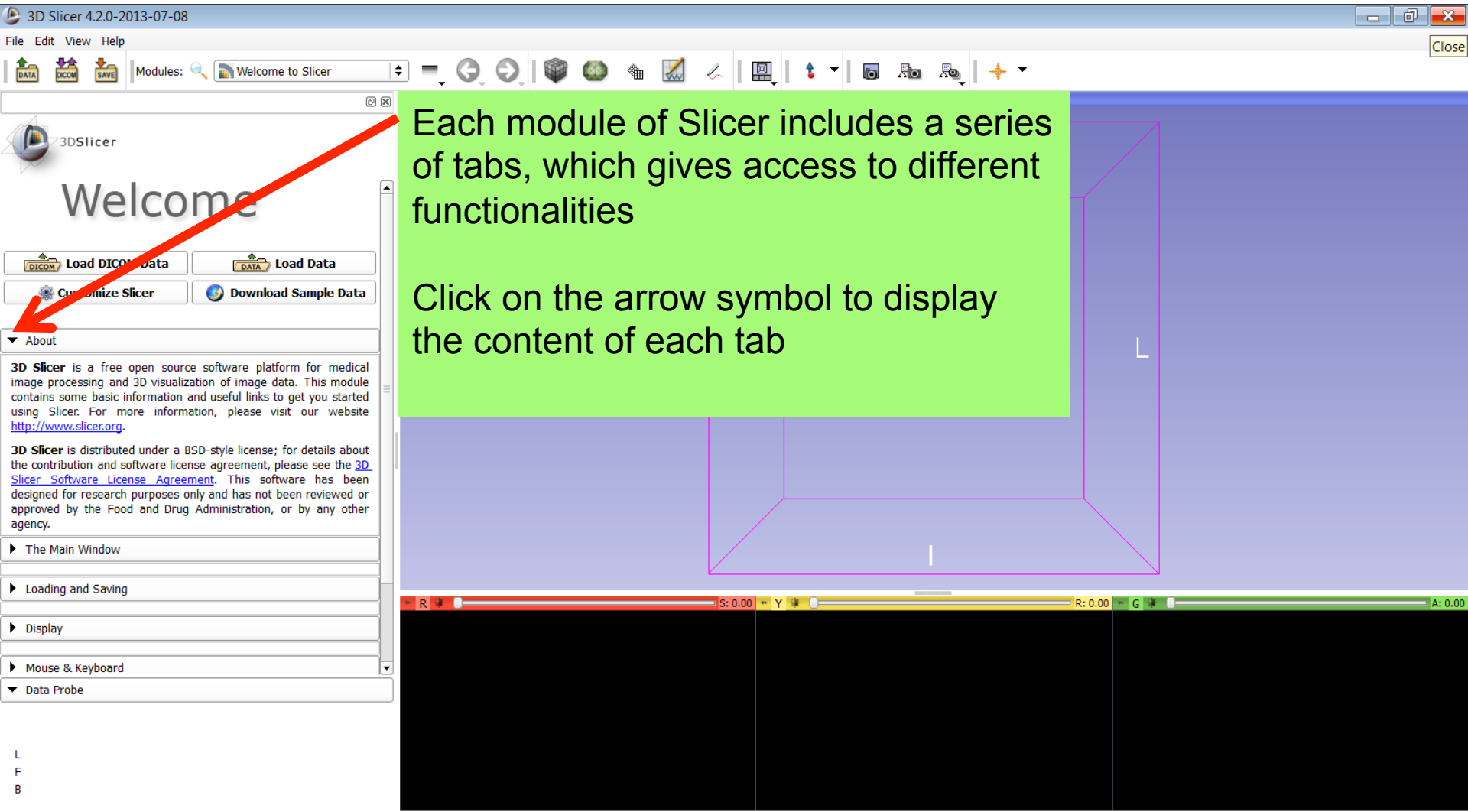
Following this tutorial, you will be able to **load and visualize volumes** within Slicer4, and to **interact in 3D** with structural images and models of the anatomy.



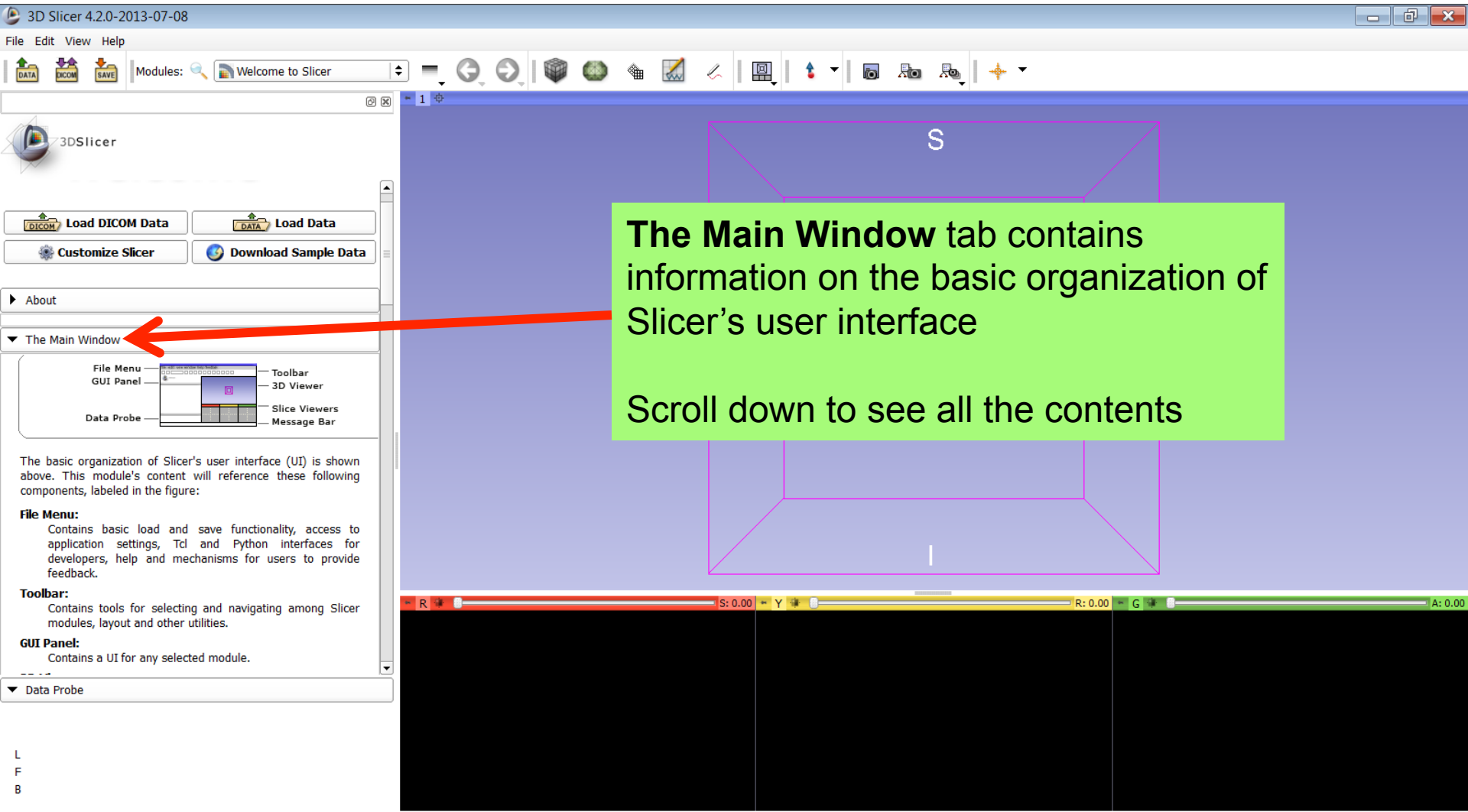
3DSlicer Version 4



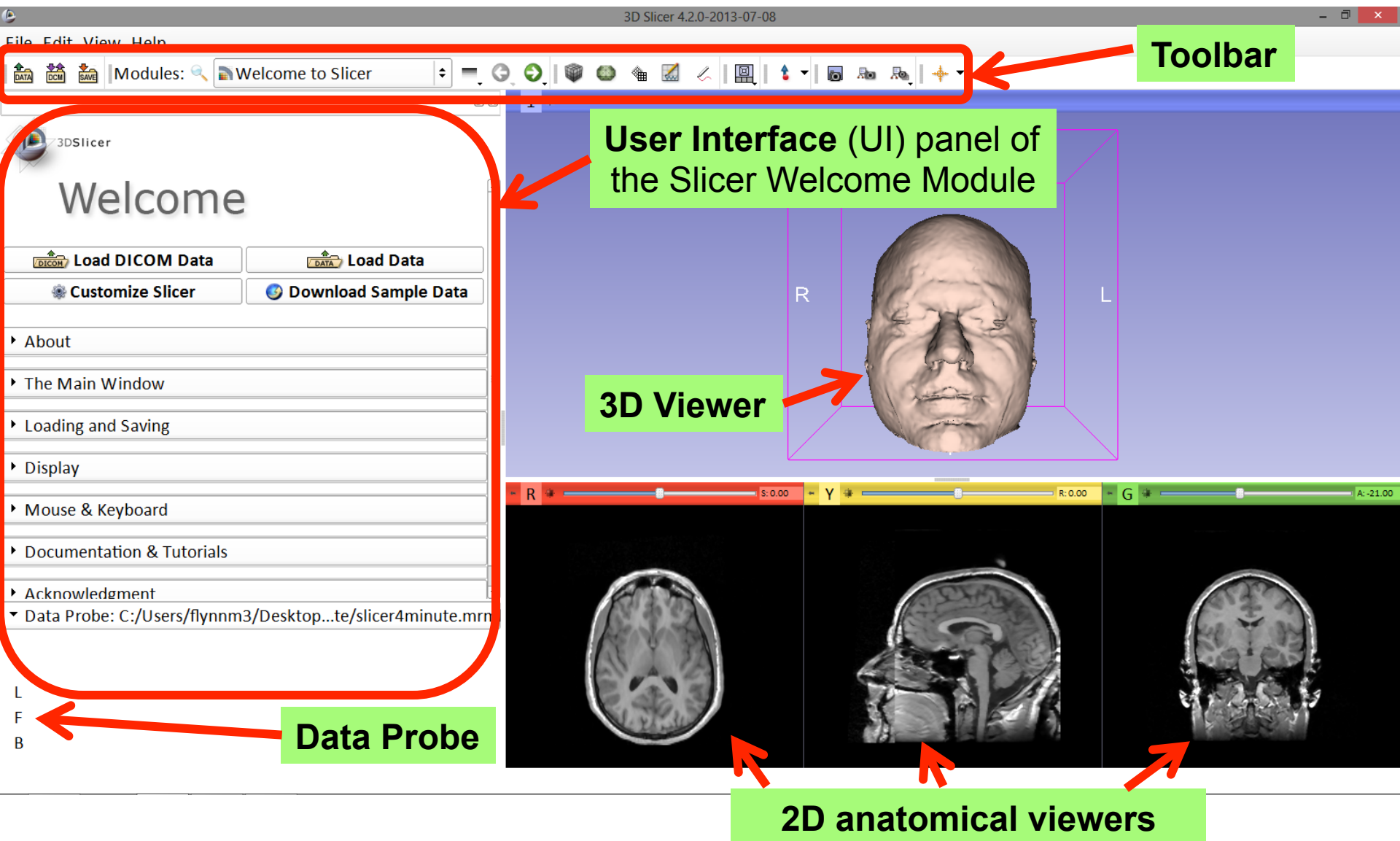
3DSlicer Version4



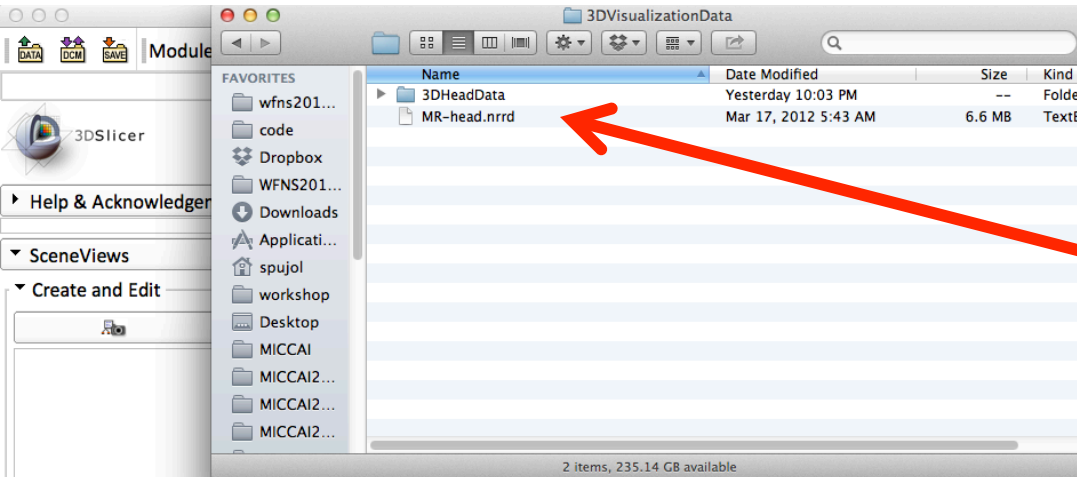
3DSlicer Version4



Slicer User Interface



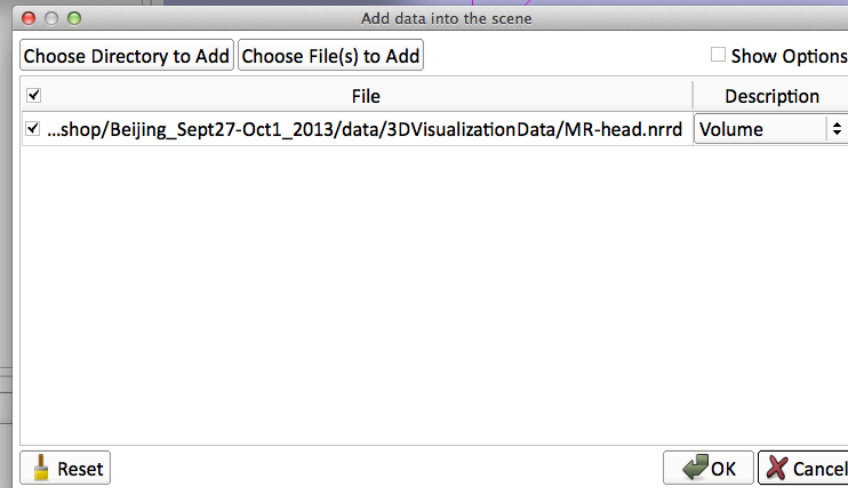
Slicer4



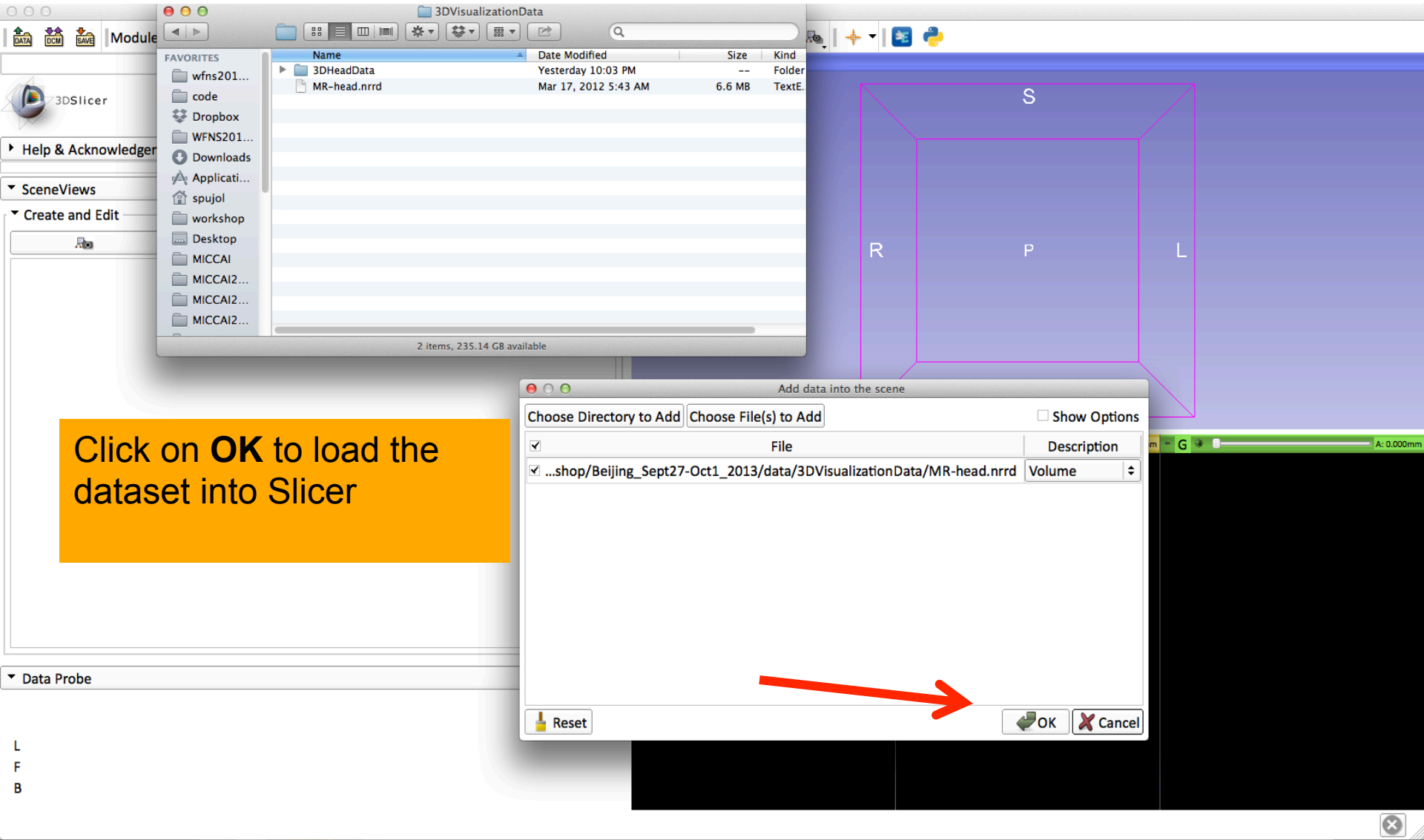
Browse to the location of the MR dataset **MR-head.nrrd** on your disk.

Drag and drop it into Slicer

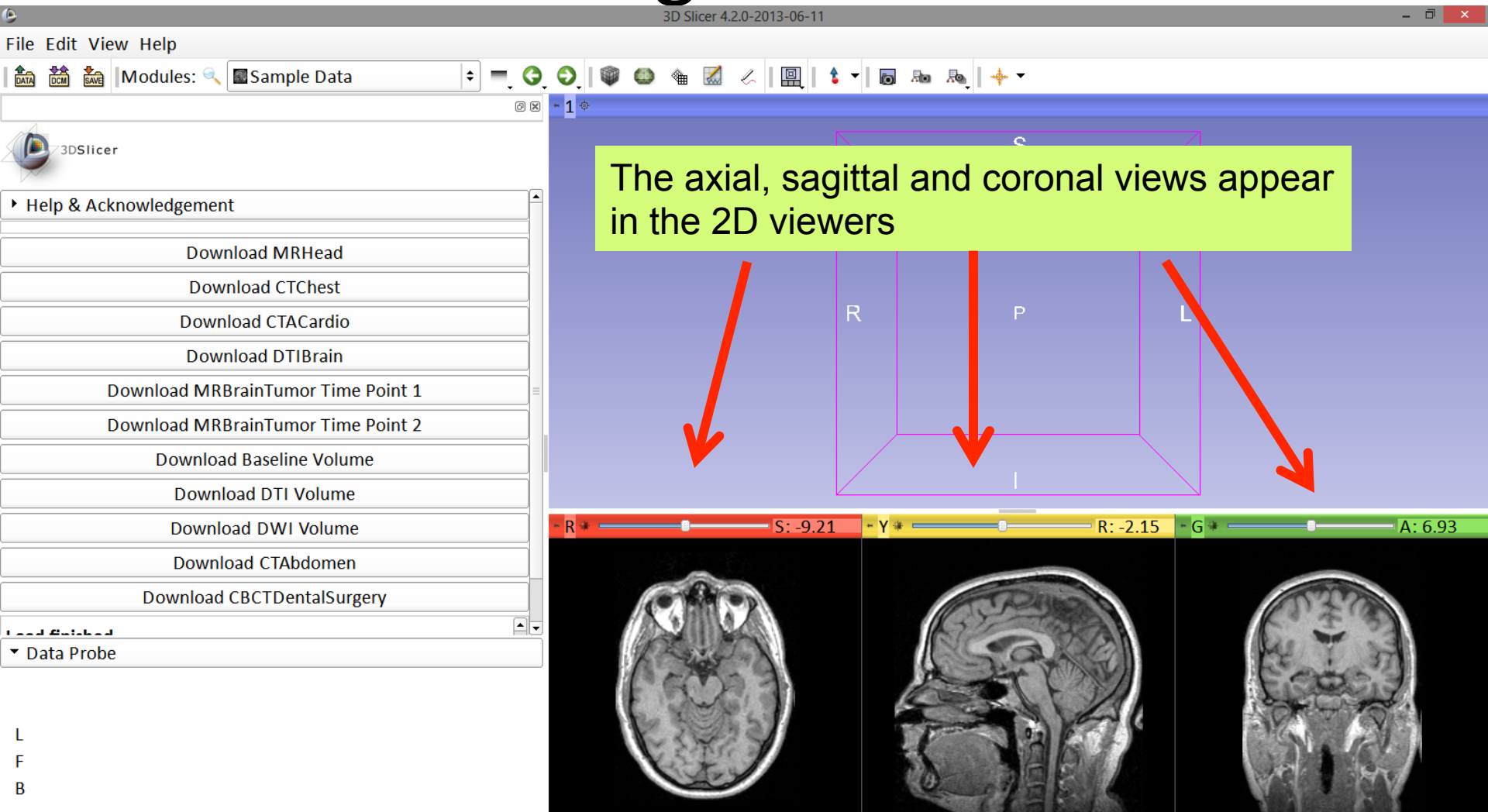
Slicer automatically opens the **'Add data into the scene'** window.



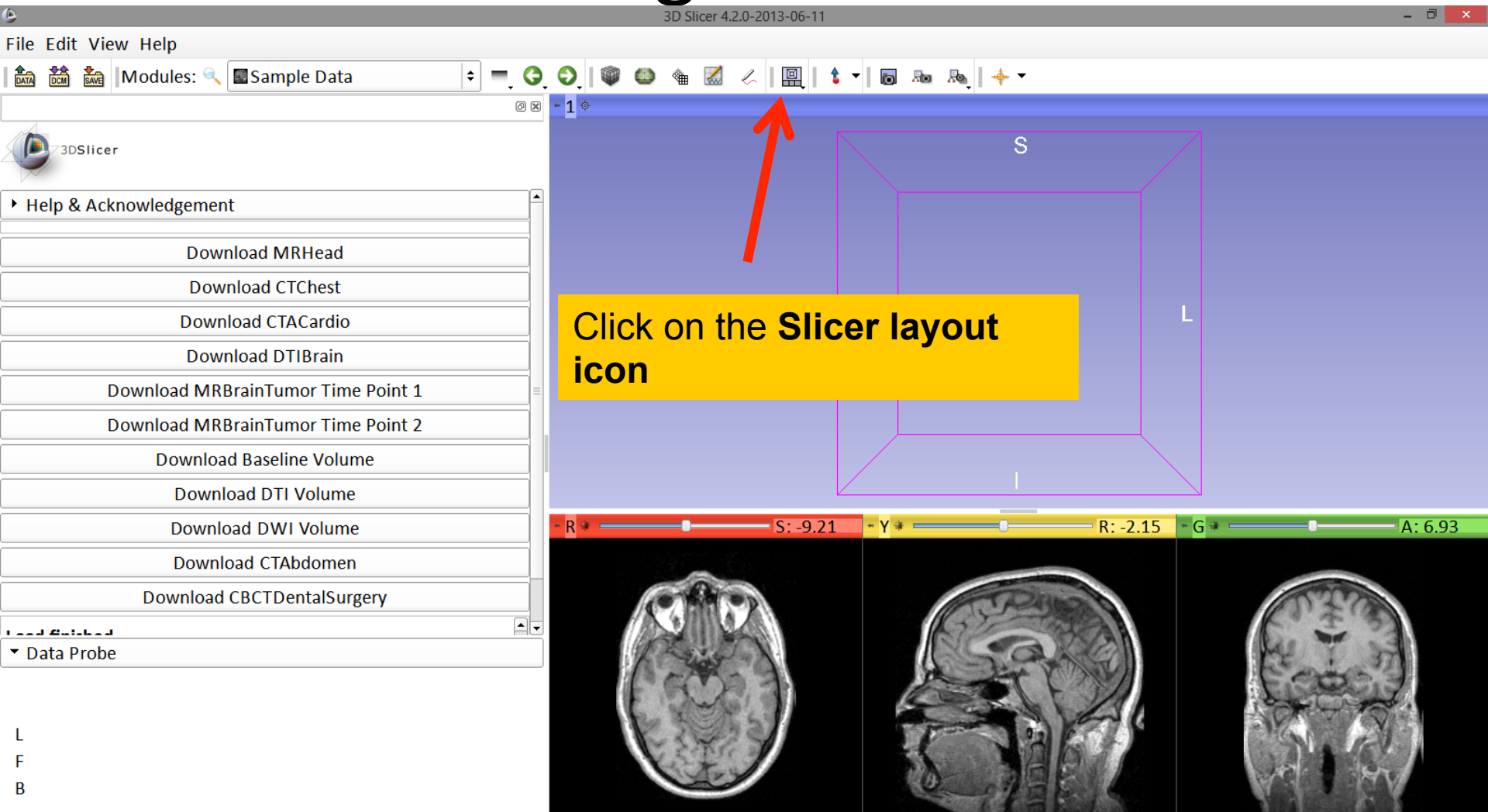
Slicer4



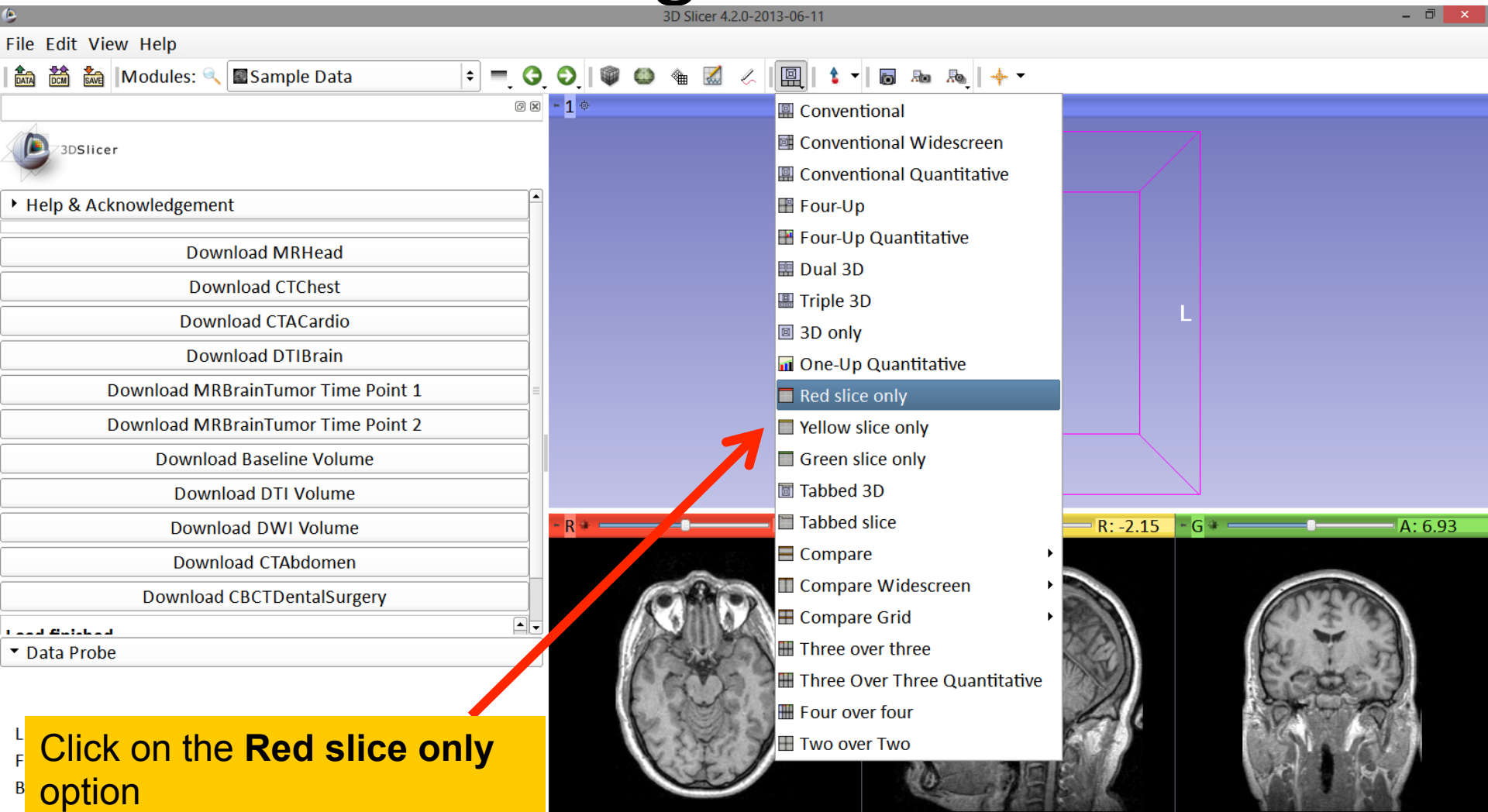
Loading a volume



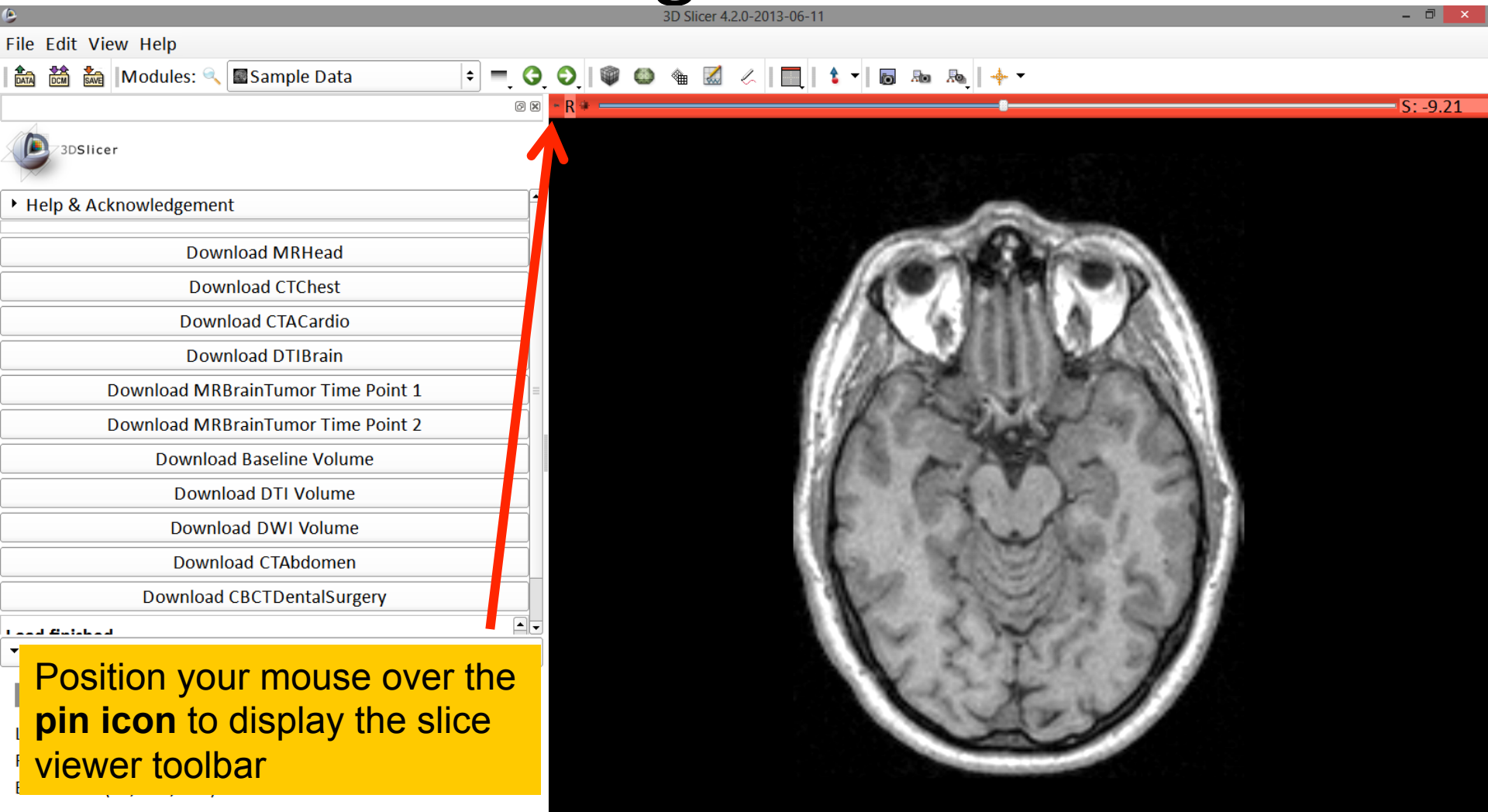
Loading a volume



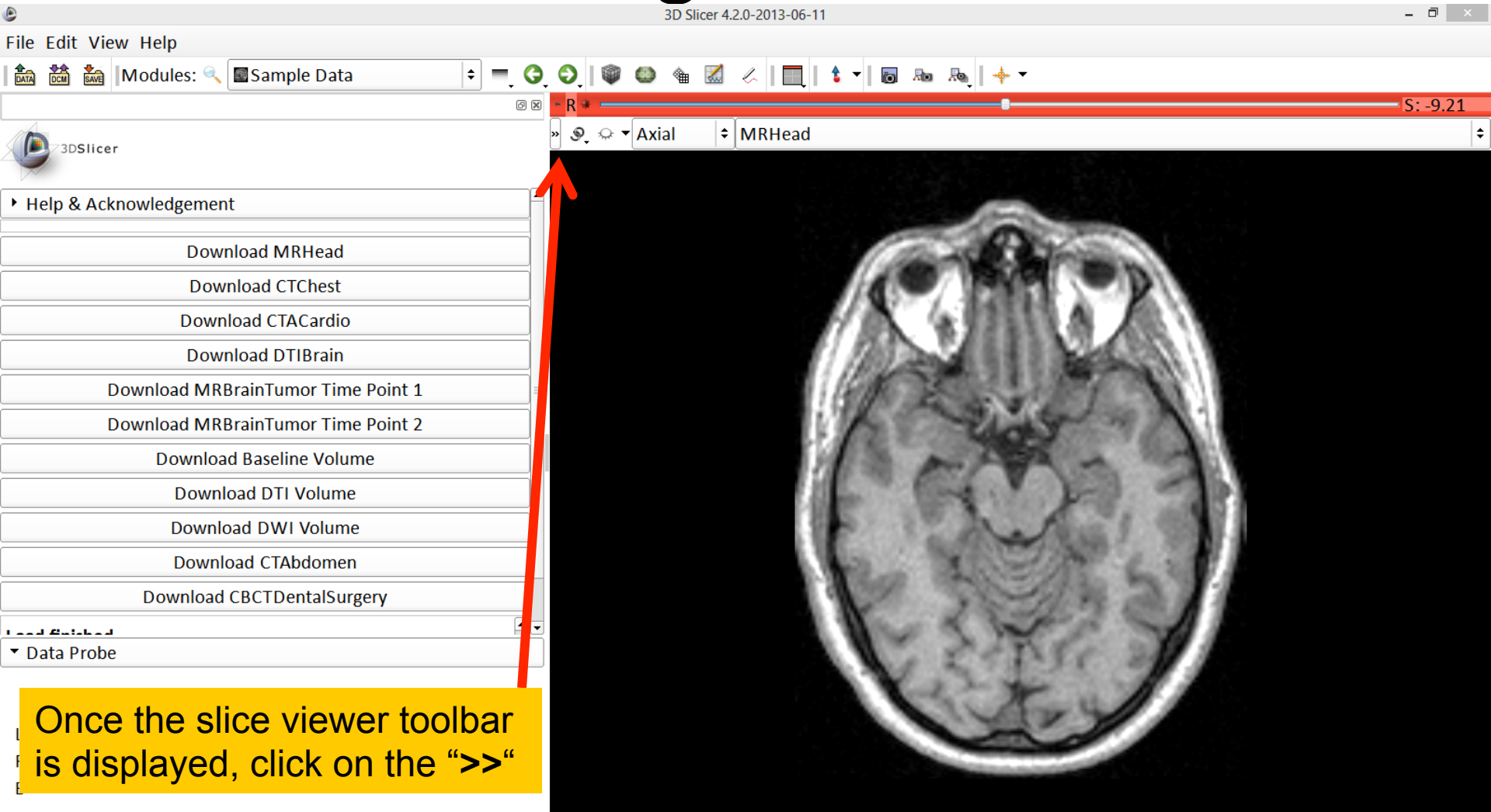
Loading a volume



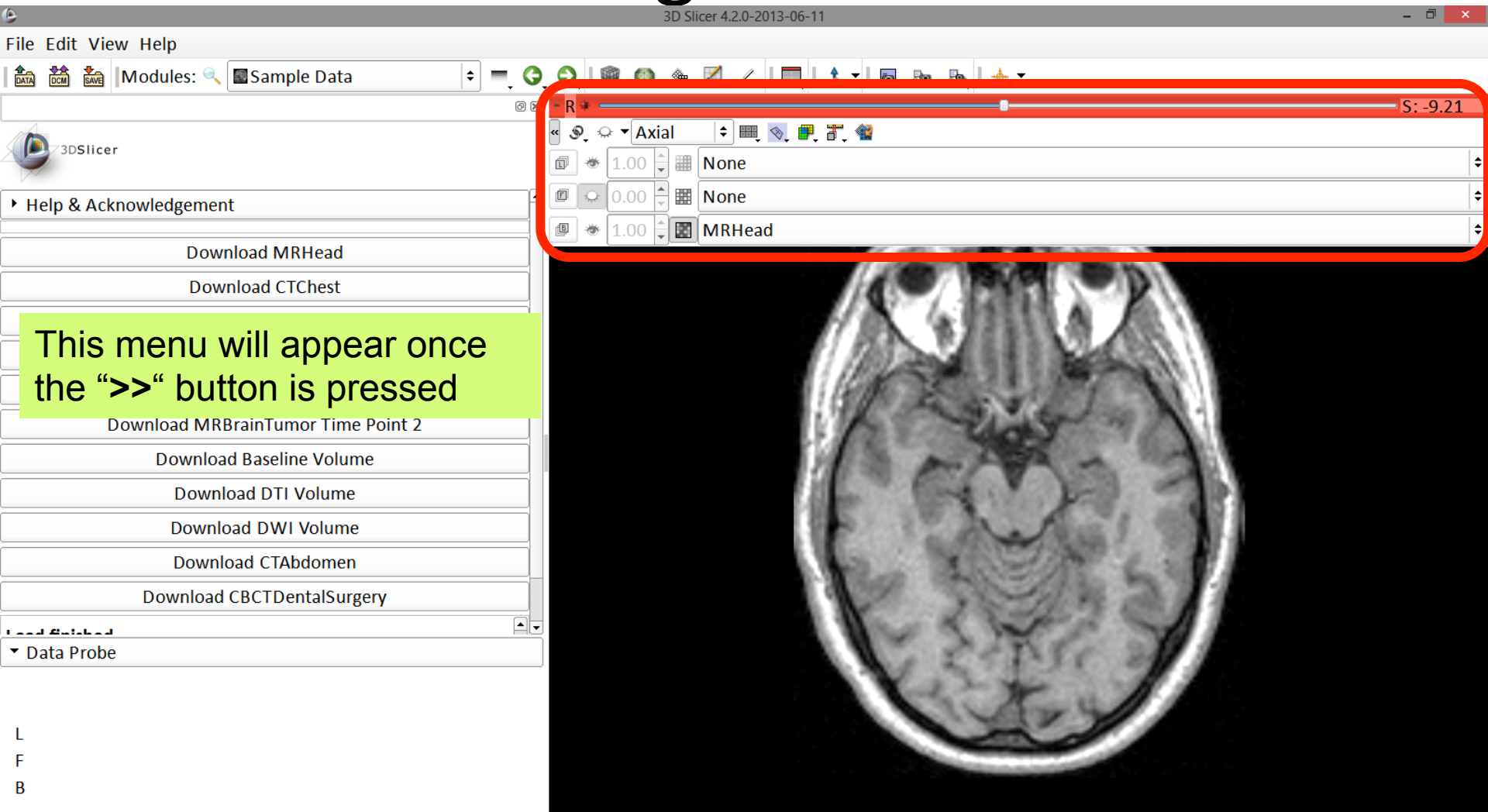
Loading a volume



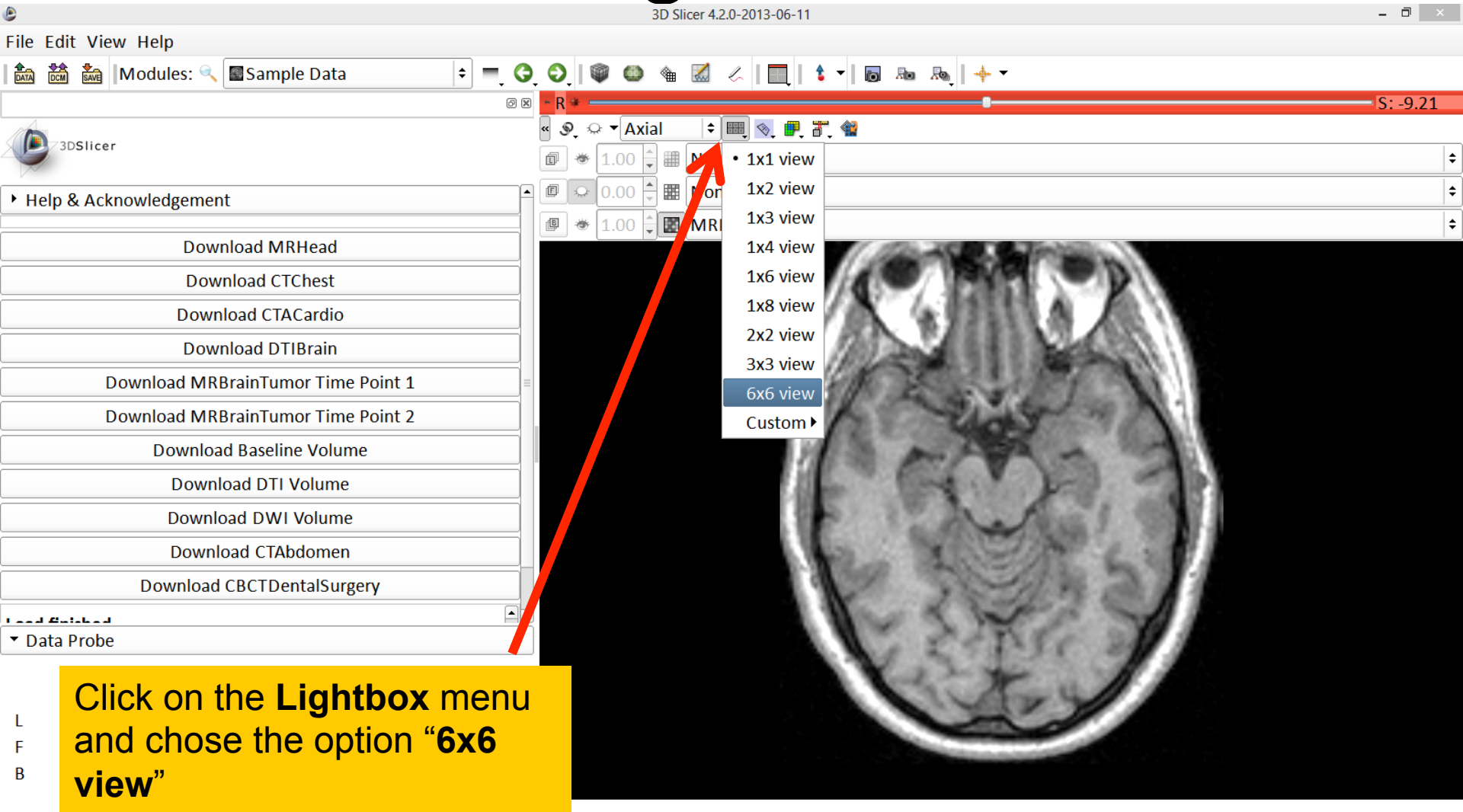
Loading a volume



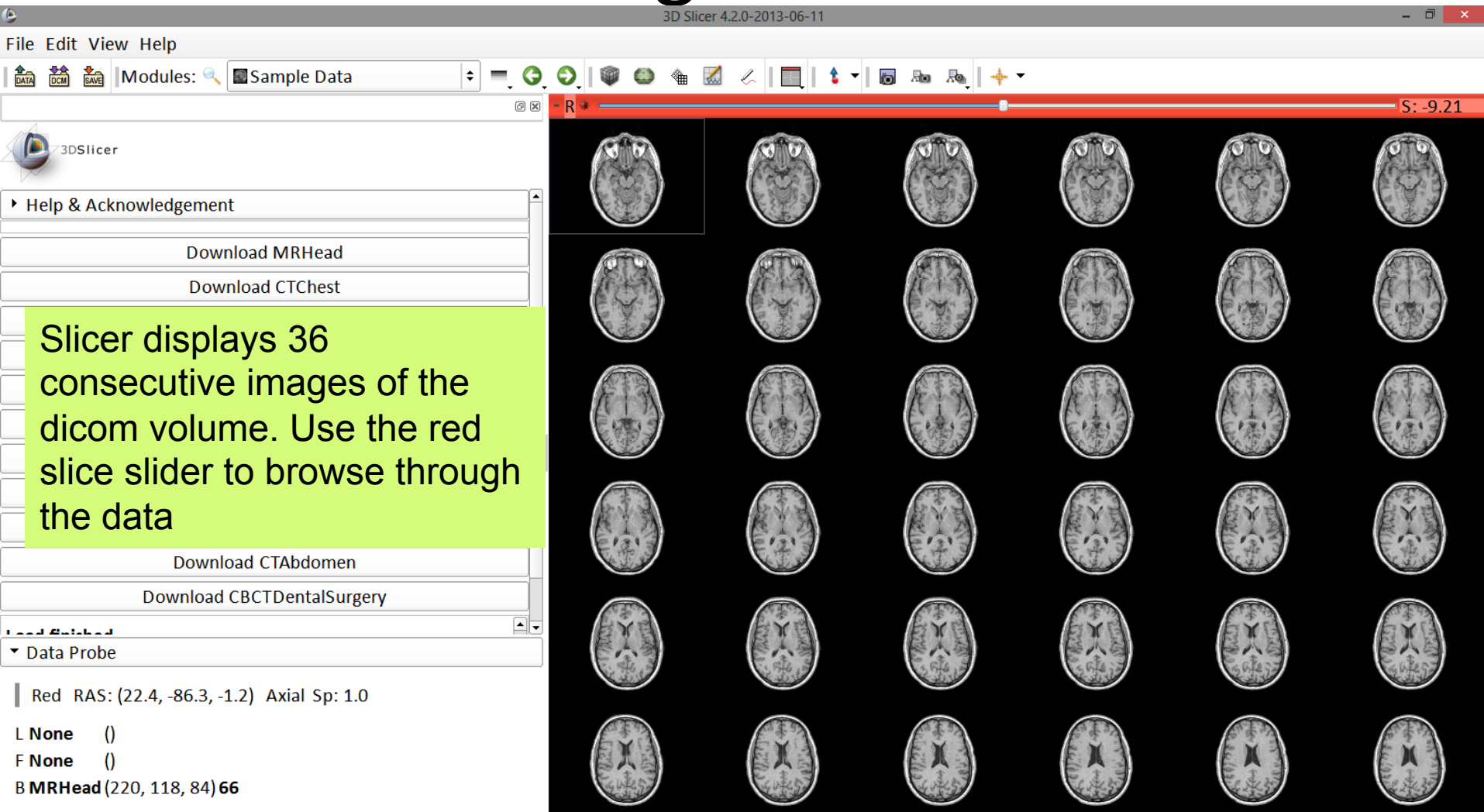
Loading a volume



Loading a volume



Loading a volume

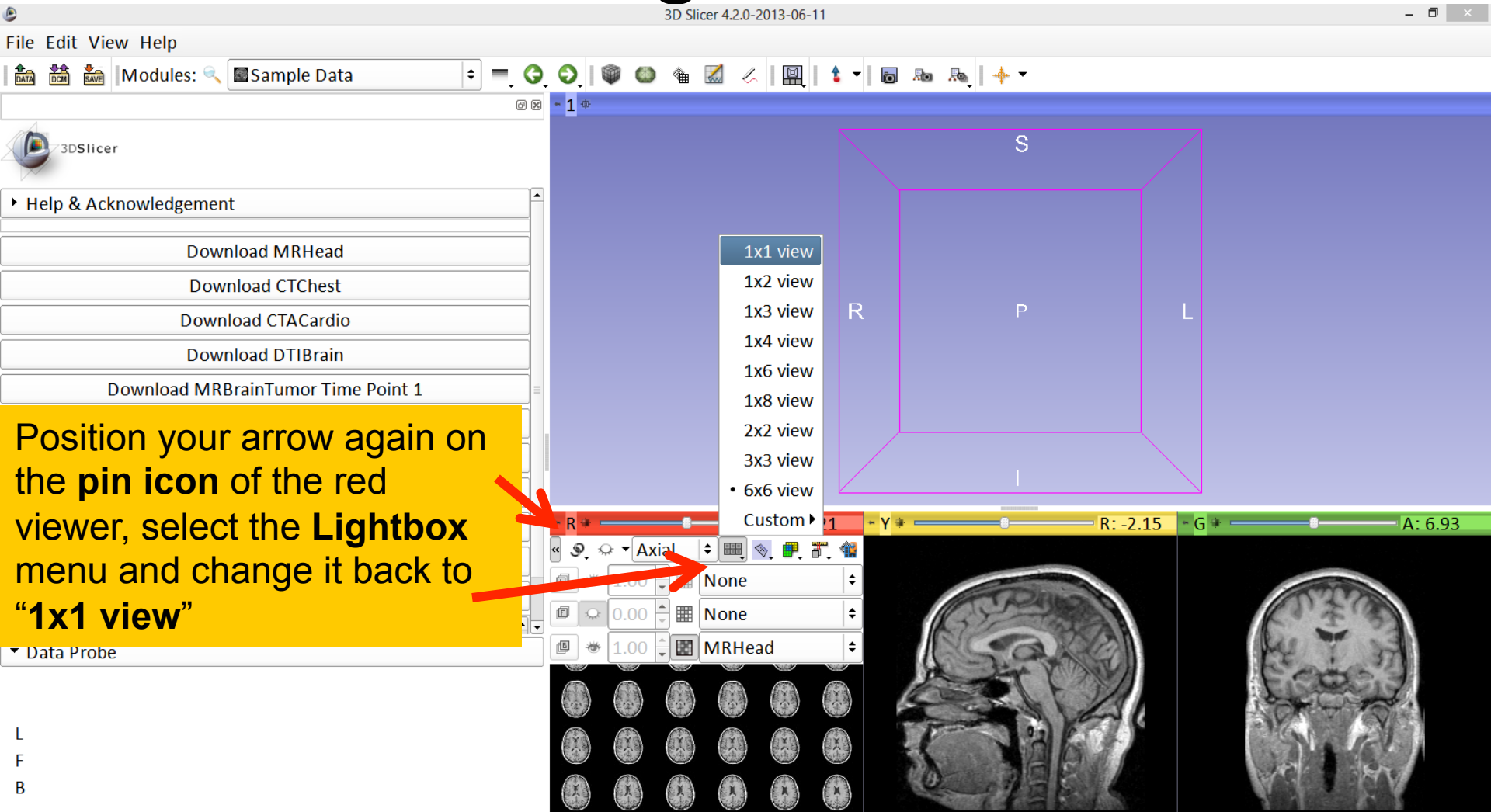


Loading a volume

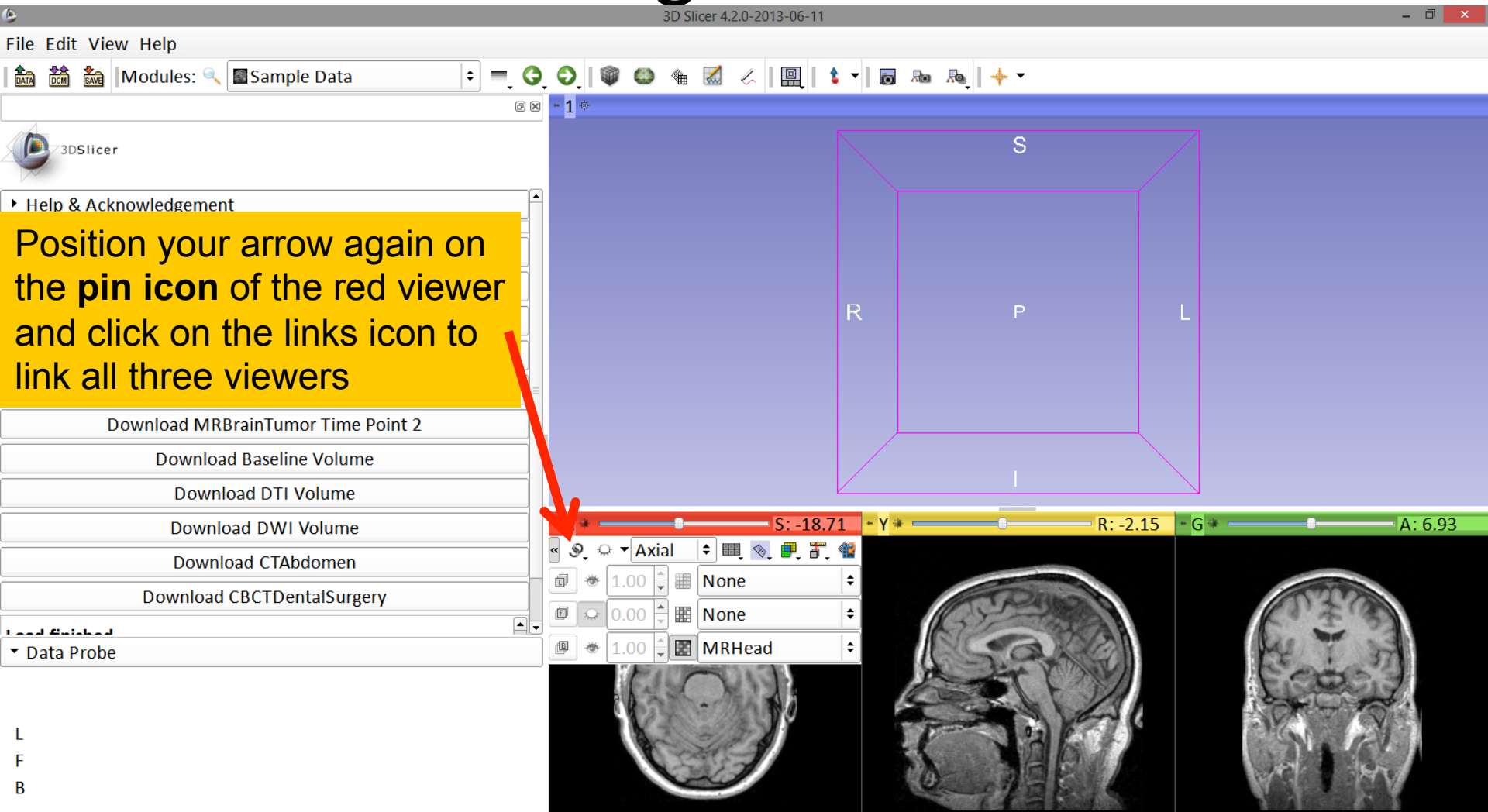
The screenshot shows the 3D Slicer 4.2.0-2013-06-11 interface. The top menu bar includes File, Edit, View, and Help. Below it is a toolbar with icons for Data, DCM, SAVE, and Modules. The 'Sample Data' module is selected. On the left, a sidebar lists 'Help & Acknowledgement' and various download links for sample data. The main window displays a grid of brain slices. A red arrow points from the 'Slicer layout' icon in the top toolbar to the 'Conventional' layout option in the dropdown menu. The dropdown menu lists various layout options: Conventional, Conventional Widescreen, Conventional Quantitative, Four-Up, Four-Up Quantitative, Dual 3D, Triple 3D, 3D only, One-Up Quantitative, Red slice only, Yellow slice only, Green slice only, Tabbed 3D, Tabbed slice, Compare, Compare Widescreen, Compare Grid, Three over three, Three Over Three Quantitative, Four over four, and Two over Two. The 'Conventional' layout is currently selected.

Click on the **Slicer layout** icon and select **Conventional**

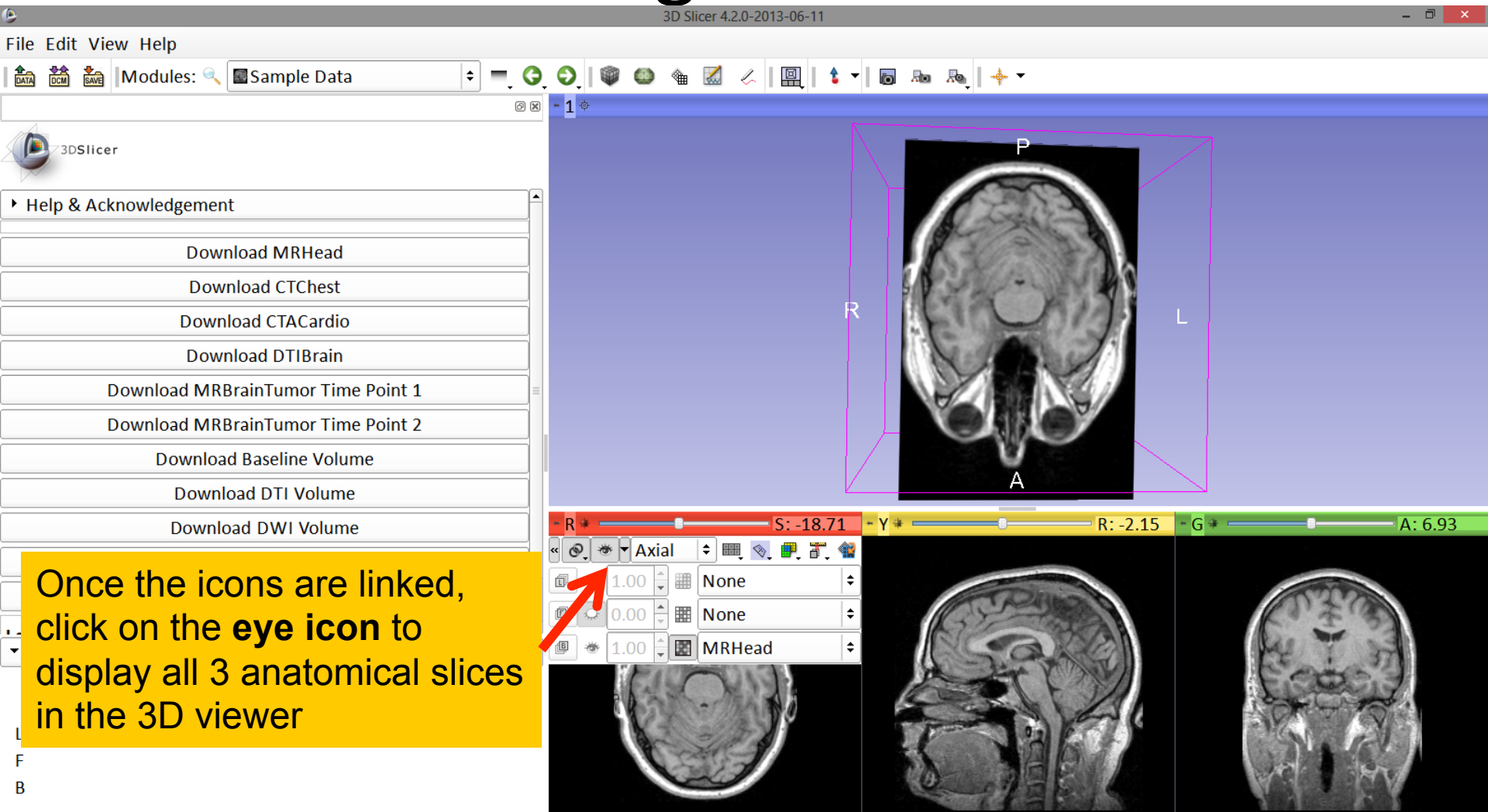
Loading a volume



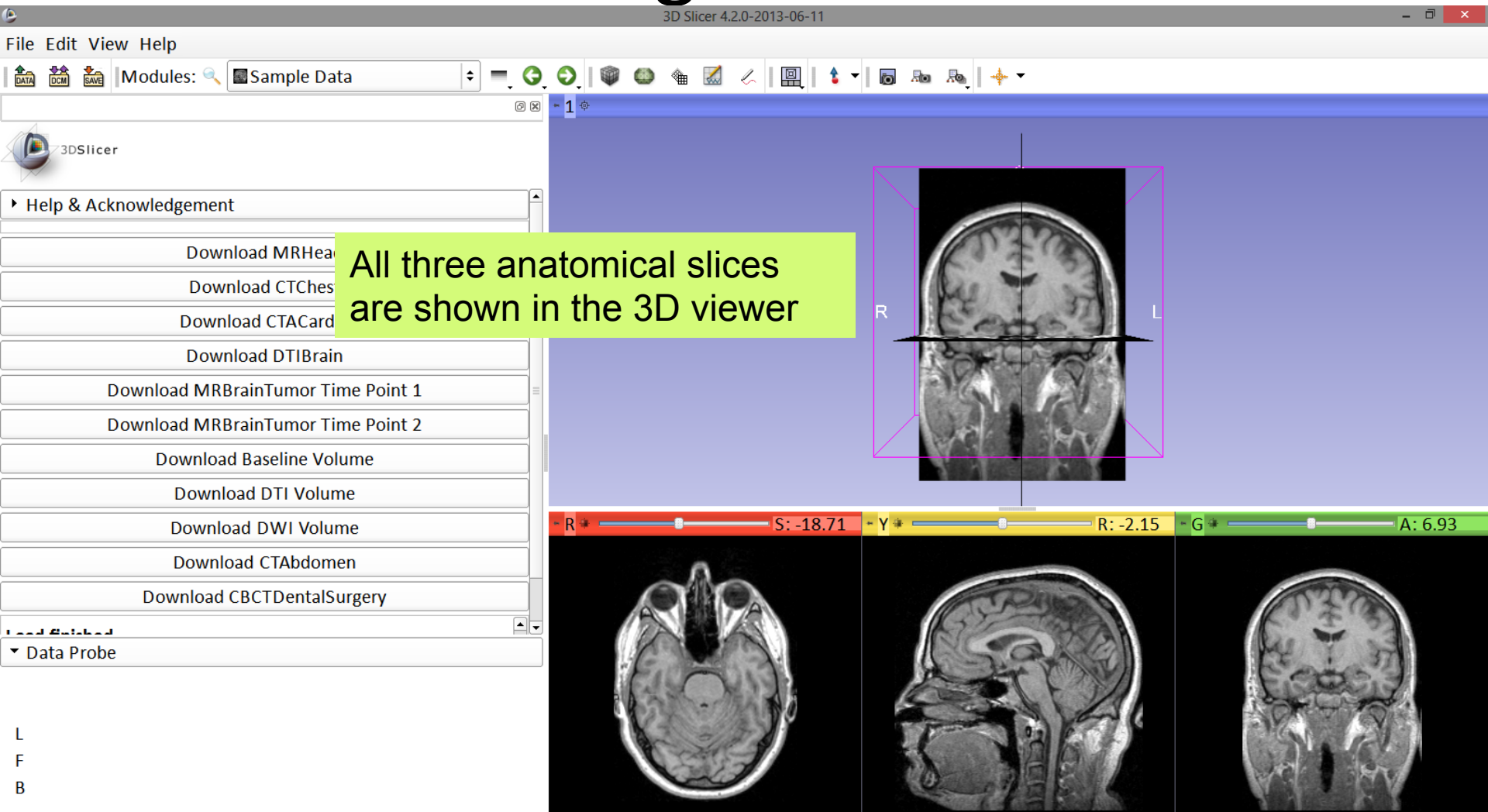
Loading a volume



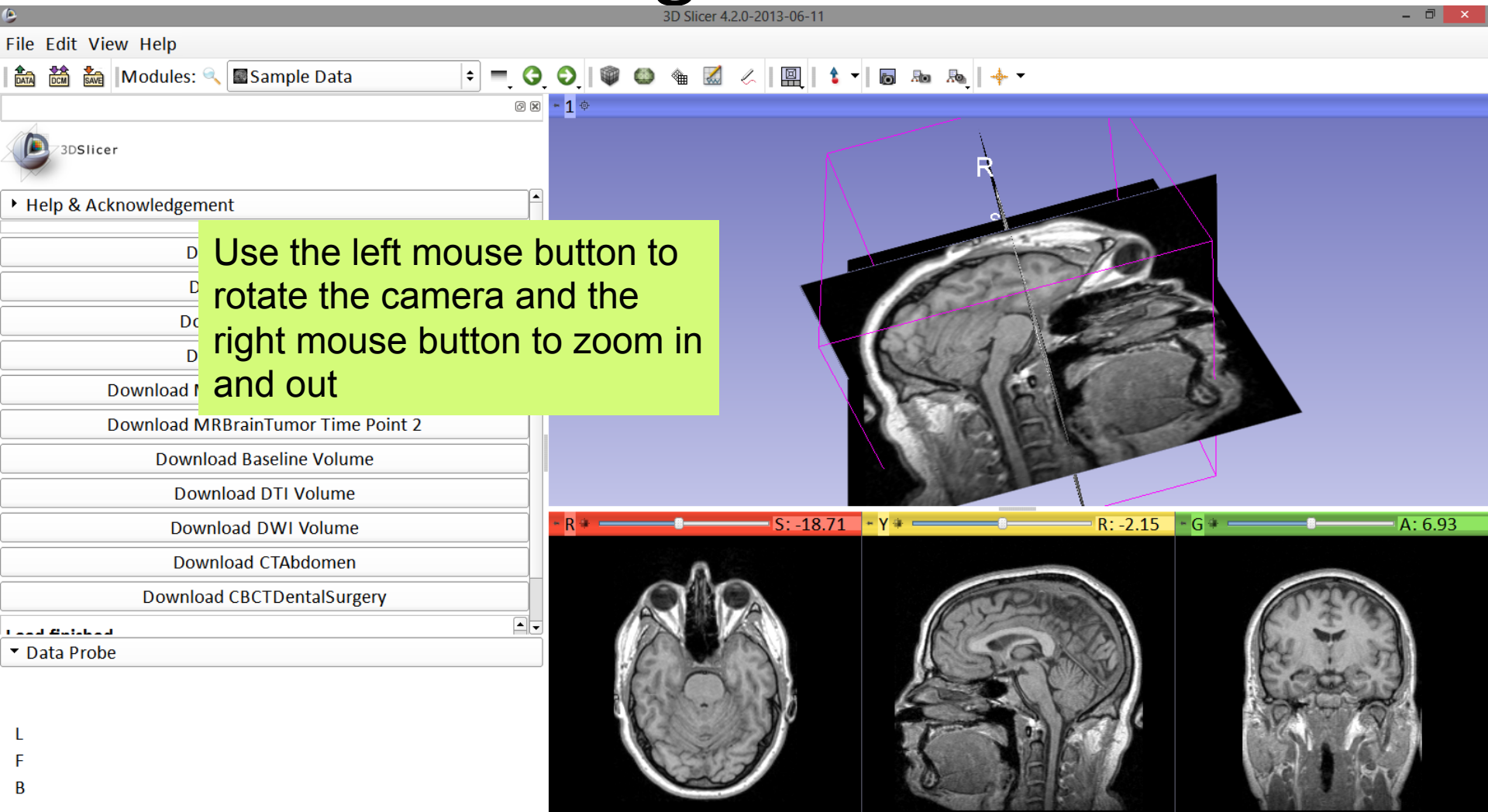
Loading a volume



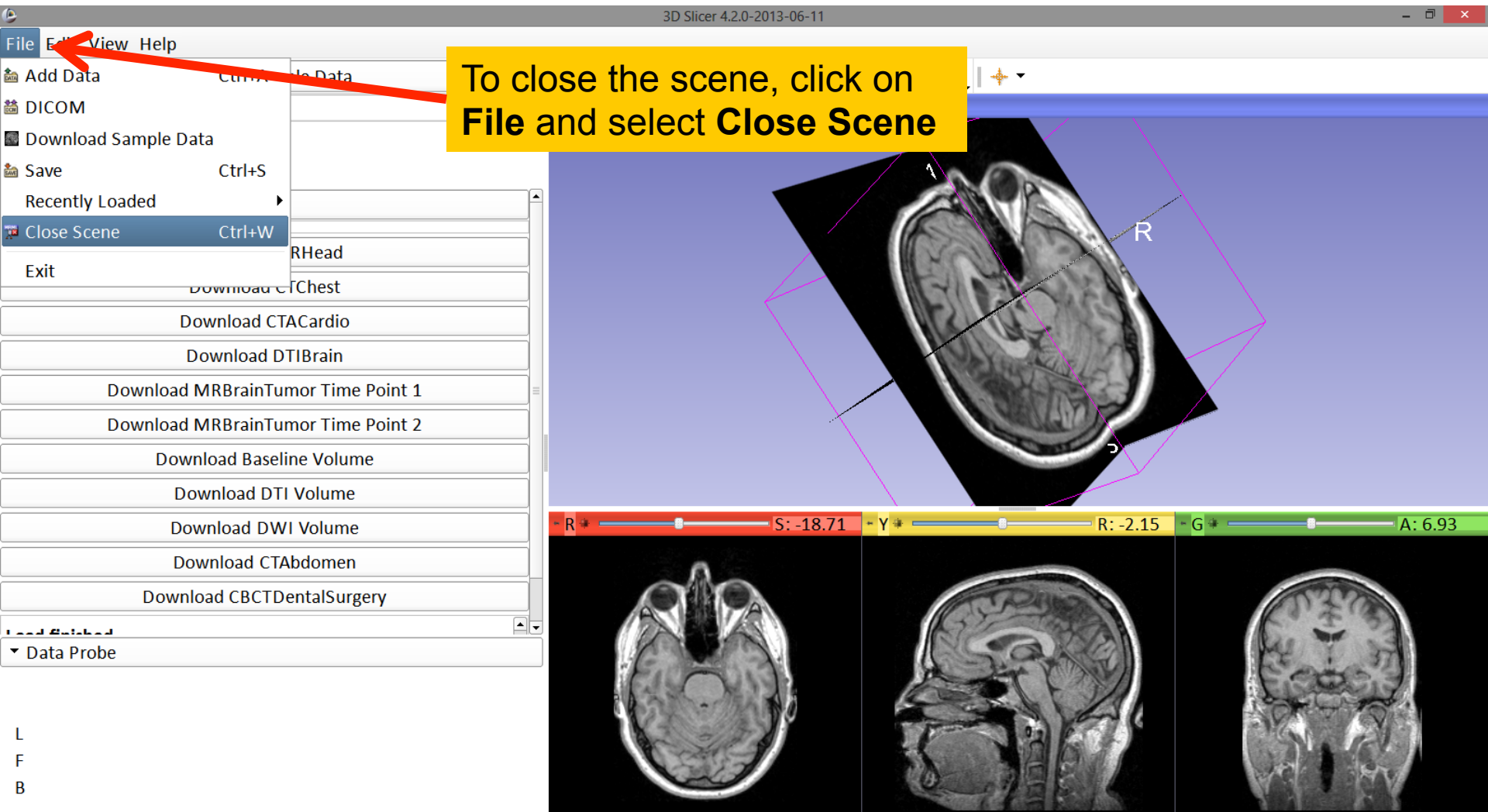
Loading a volume



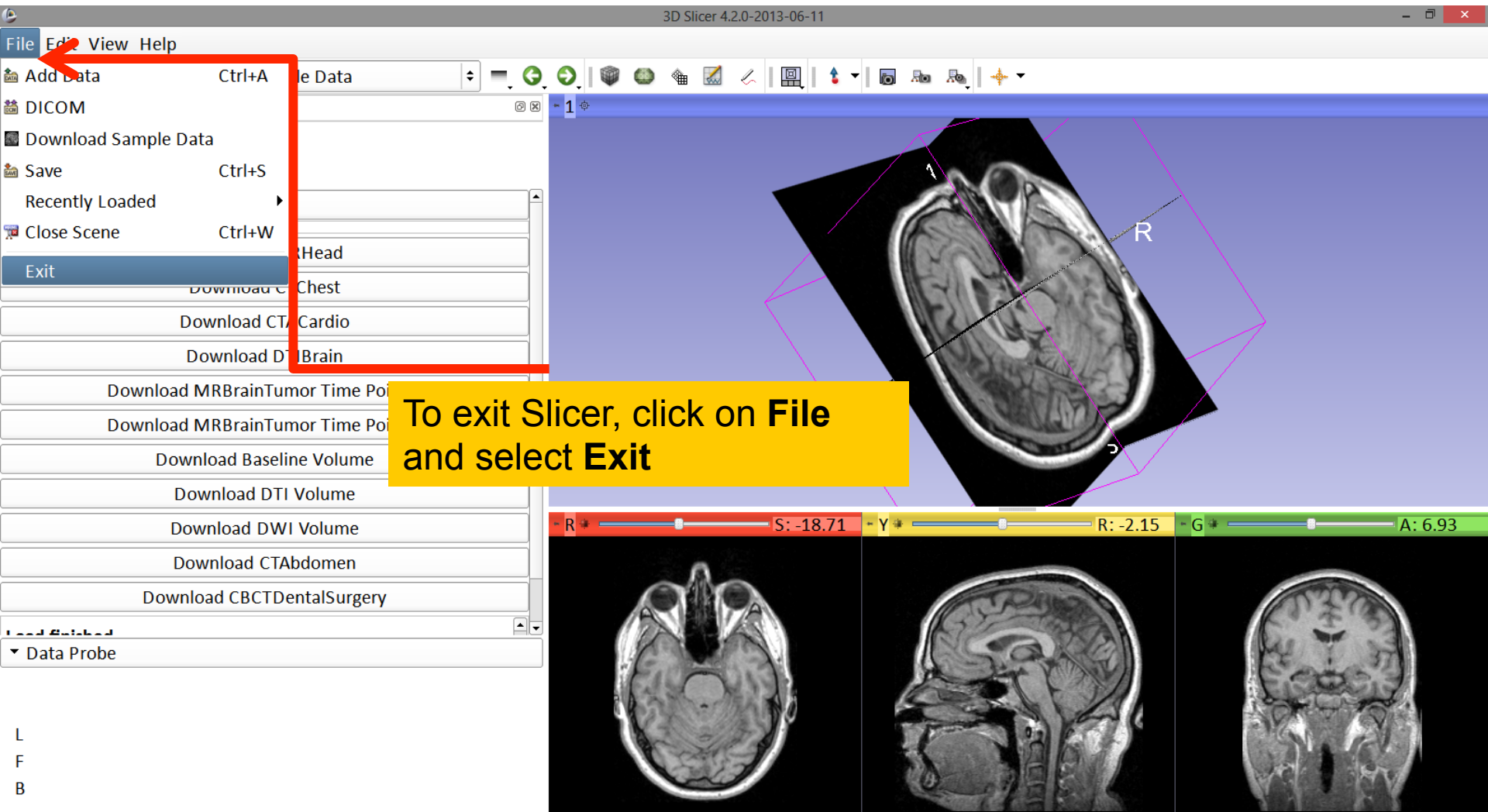
Loading a volume



Close the scene



Exit Slicer

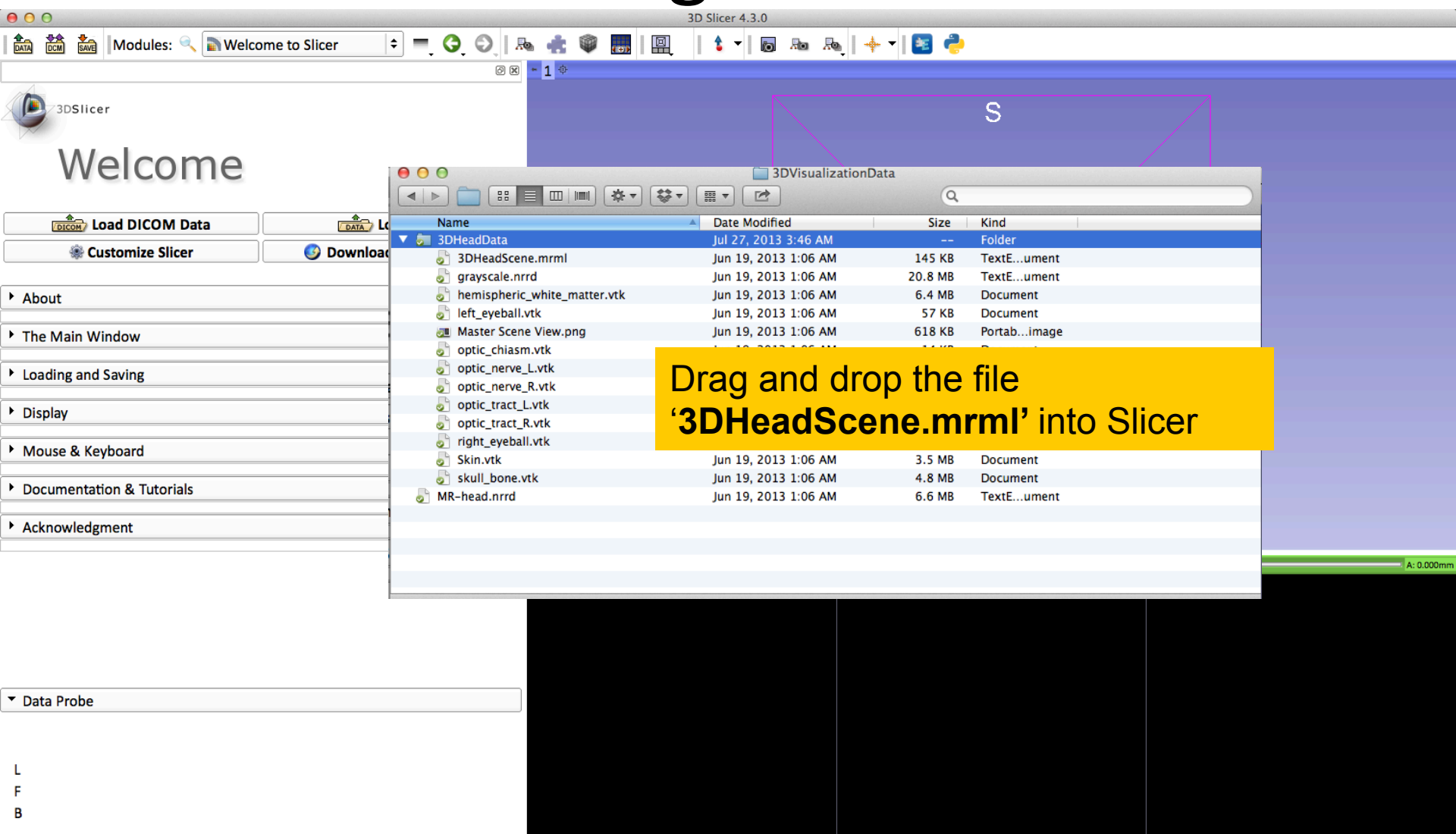




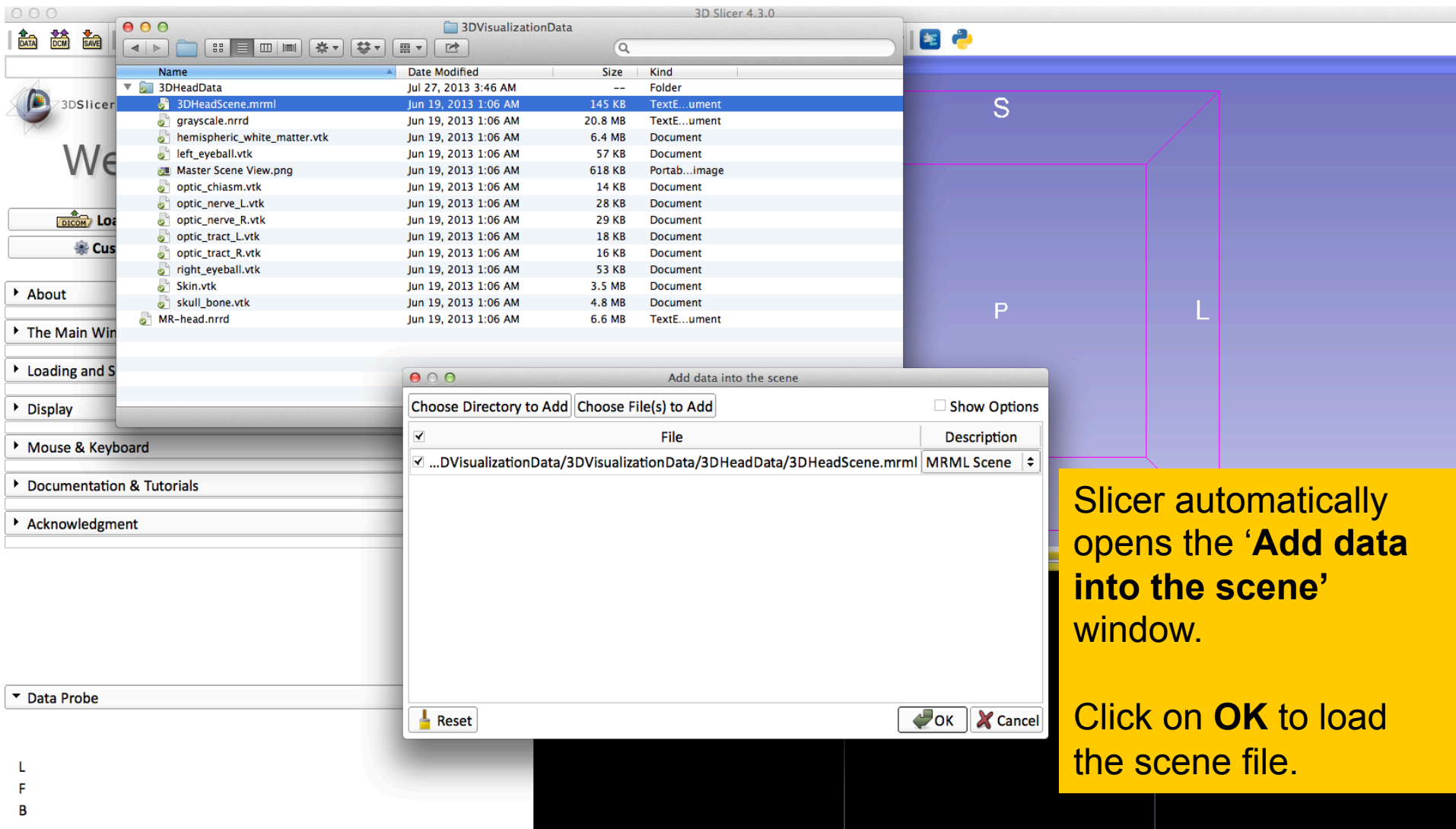
Part 2:

3D visualization of surface models of the brain

Loading a Scene



Loading a Scene



The screenshot shows the 3D Slicer 4.3.0 interface. The 'Add data into the scene' dialog box is open, displaying a list of files to add. The file '3DHeadScene.mrml' is selected. The background shows the 3D Slicer interface with a 3D view of a brain scan and a list of data sets on the left.

Name	Date Modified	Size	Kind
3DHeadData	Jul 27, 2013 3:46 AM	--	Folder
3DHeadScene.mrml	Jun 19, 2013 1:06 AM	145 KB	TextE...ument
grayscale.nrrd	Jun 19, 2013 1:06 AM	20.8 MB	TextE...ument
hemispheric_white_matter.vtk	Jun 19, 2013 1:06 AM	6.4 MB	Document
left_eyeball.vtk	Jun 19, 2013 1:06 AM	57 KB	Document
Master Scene View.png	Jun 19, 2013 1:06 AM	618 KB	Portab...image
optic_chiasm.vtk	Jun 19, 2013 1:06 AM	14 KB	Document
optic_nerve_L.vtk	Jun 19, 2013 1:06 AM	28 KB	Document
optic_nerve_R.vtk	Jun 19, 2013 1:06 AM	29 KB	Document
optic_tract_L.vtk	Jun 19, 2013 1:06 AM	18 KB	Document
optic_tract_R.vtk	Jun 19, 2013 1:06 AM	16 KB	Document
right_eyeball.vtk	Jun 19, 2013 1:06 AM	53 KB	Document
Skin.vtk	Jun 19, 2013 1:06 AM	3.5 MB	Document
skull_bone.vtk	Jun 19, 2013 1:06 AM	4.8 MB	Document
MR-head.nrrd	Jun 19, 2013 1:06 AM	6.6 MB	TextE...ument

The 'Add data into the scene' dialog box is open, displaying a list of files to add. The file '3DHeadScene.mrml' is selected. The dialog box has a 'Choose Directory to Add' button, a 'Choose File(s) to Add' button, and a 'Show Options' checkbox. The list of files is as follows:

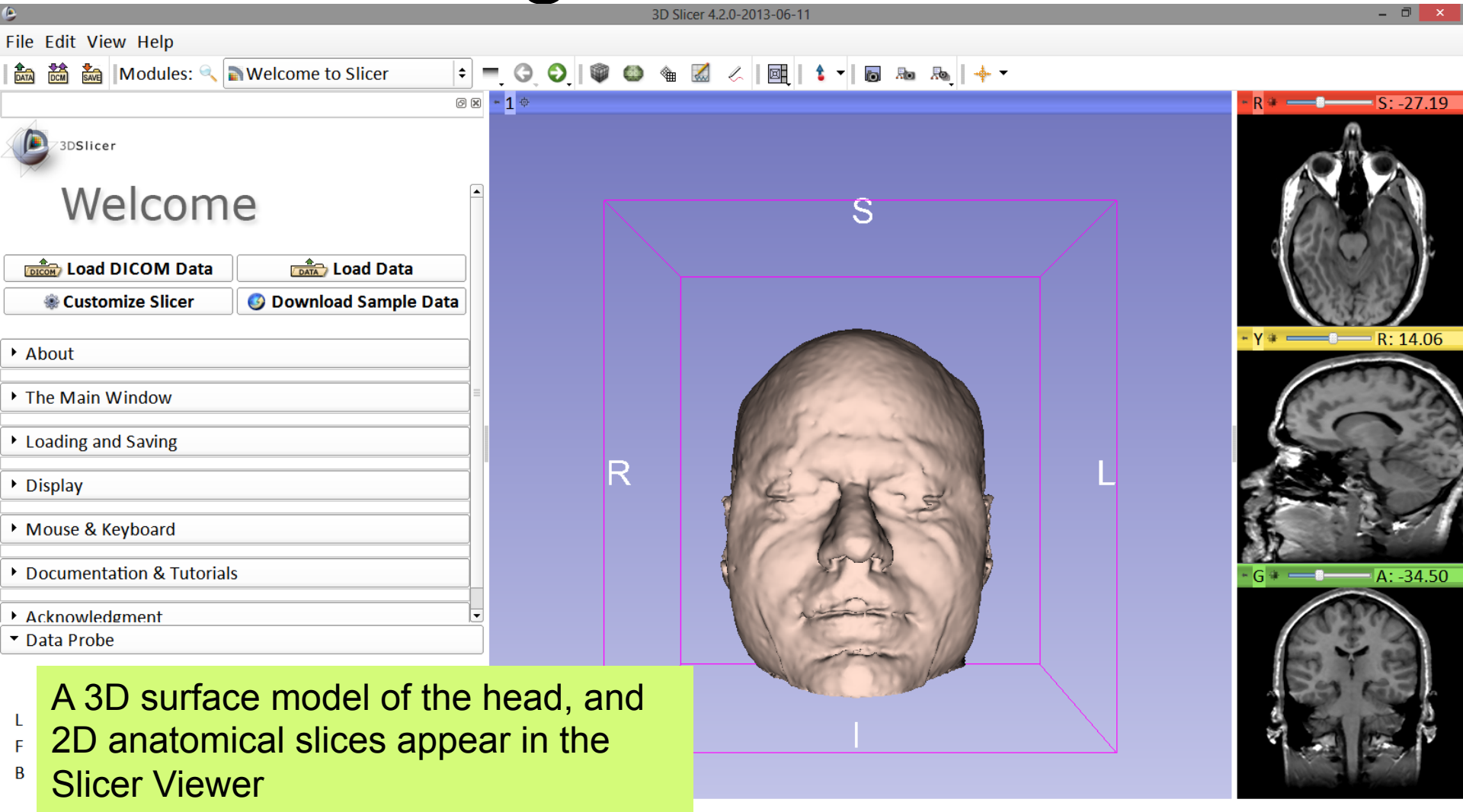
File	Description
...DVisualizationData/3DVisualizationData/3DHeadData/3DHeadScene.mrml	MRML Scene

Buttons: Reset, OK, Cancel.

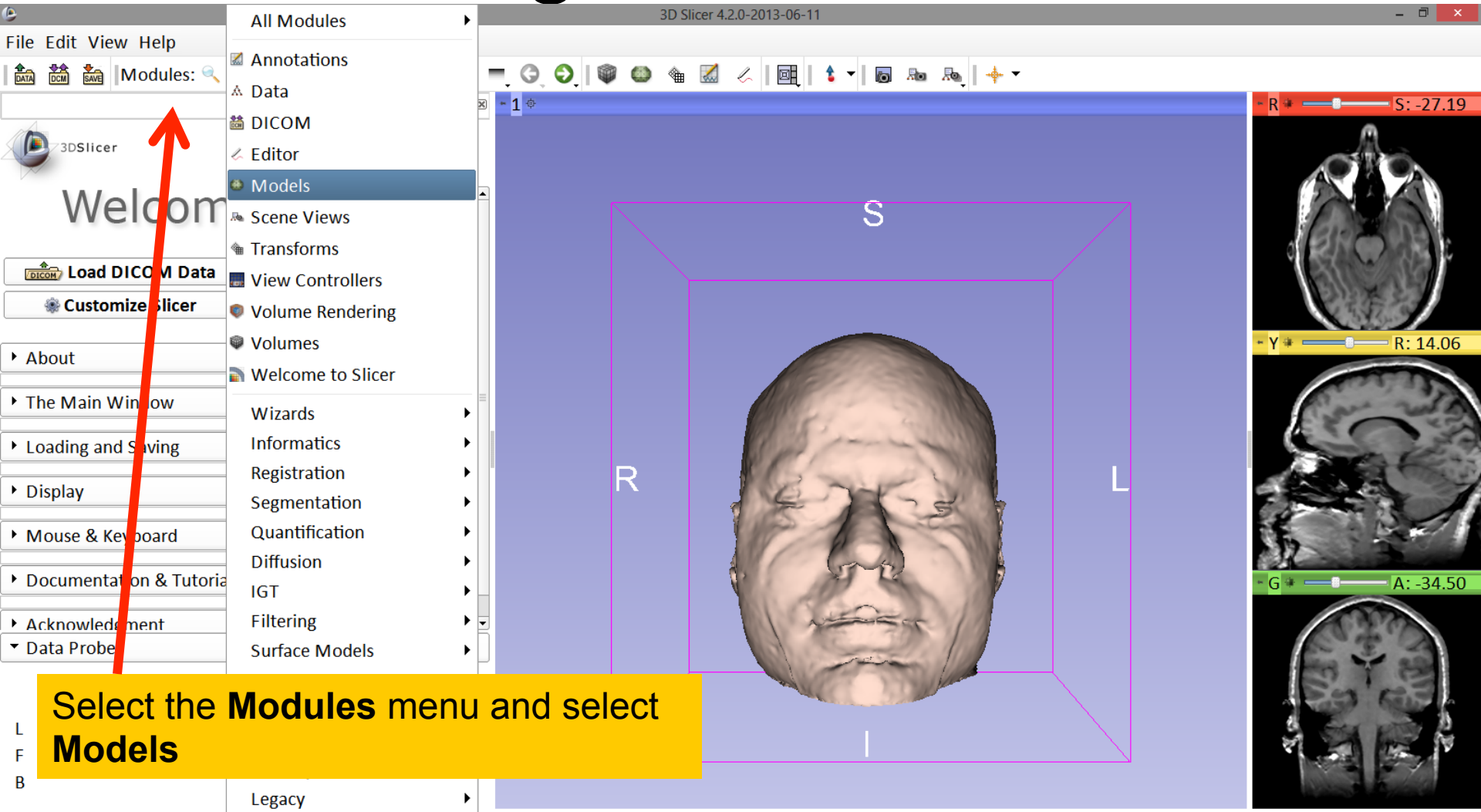
Slicer automatically opens the 'Add data into the scene' window.

Click on **OK** to load the scene file.

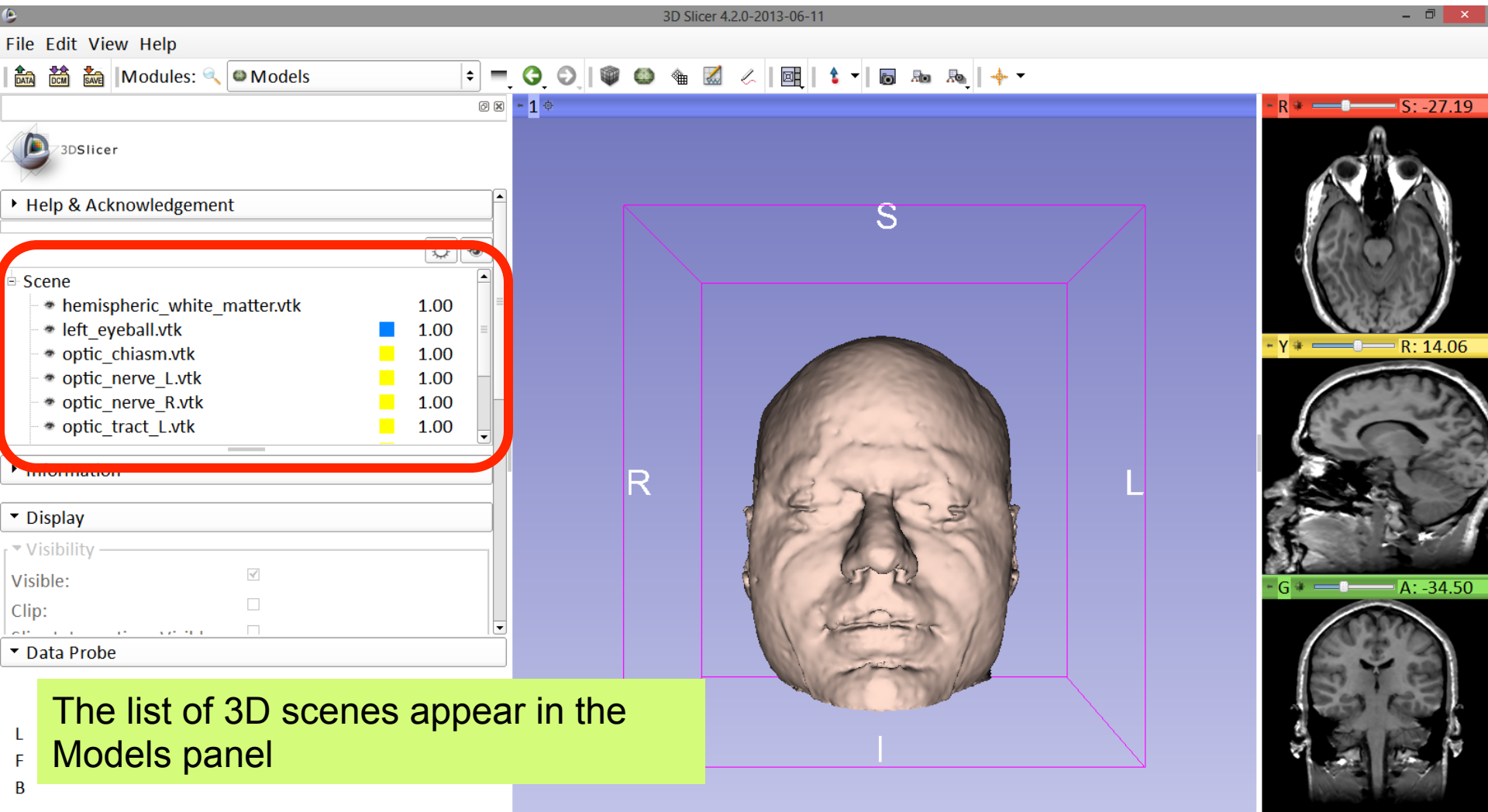
Loading the Slicer Scene



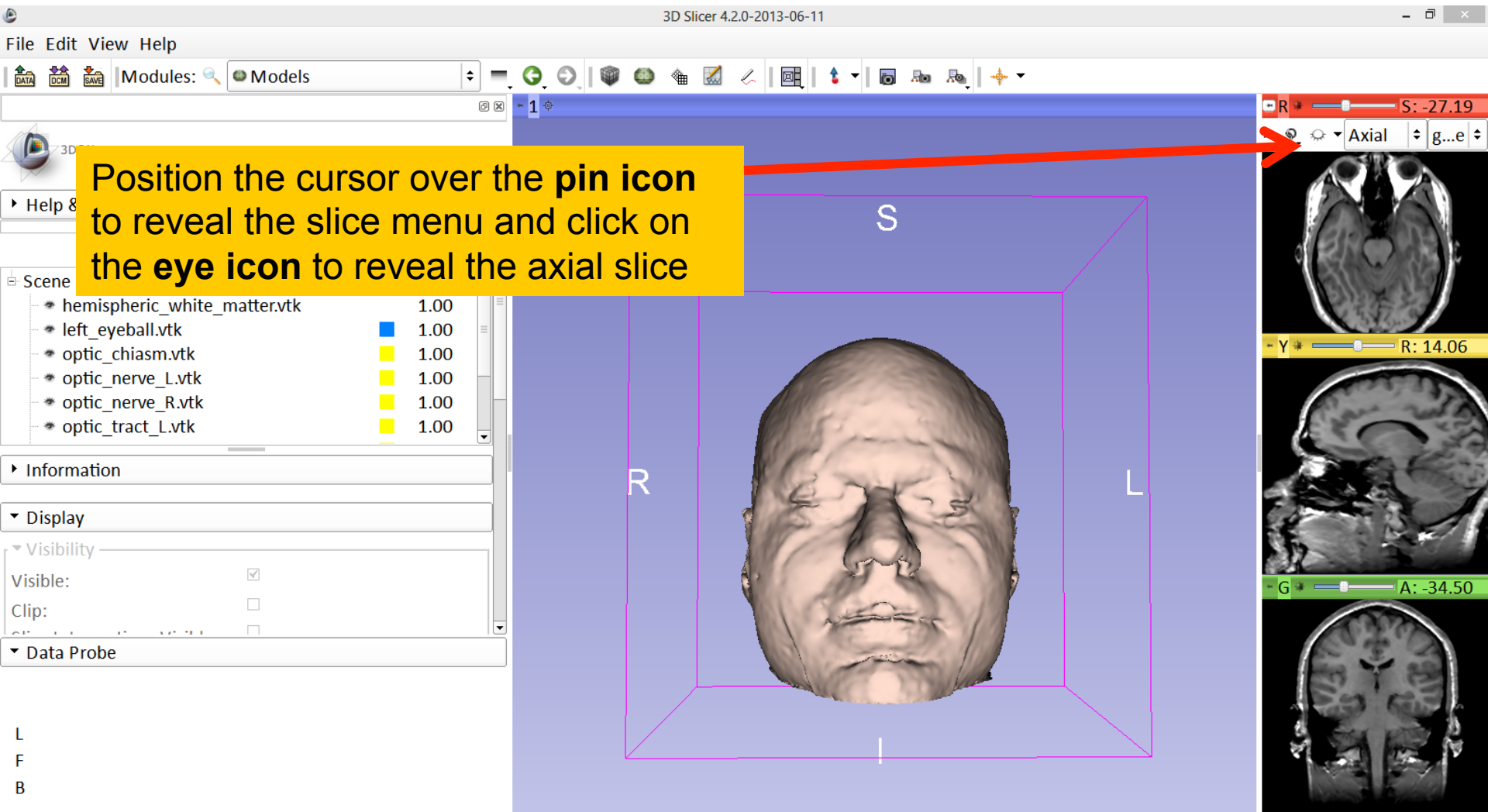
Loading the Slicer Scene



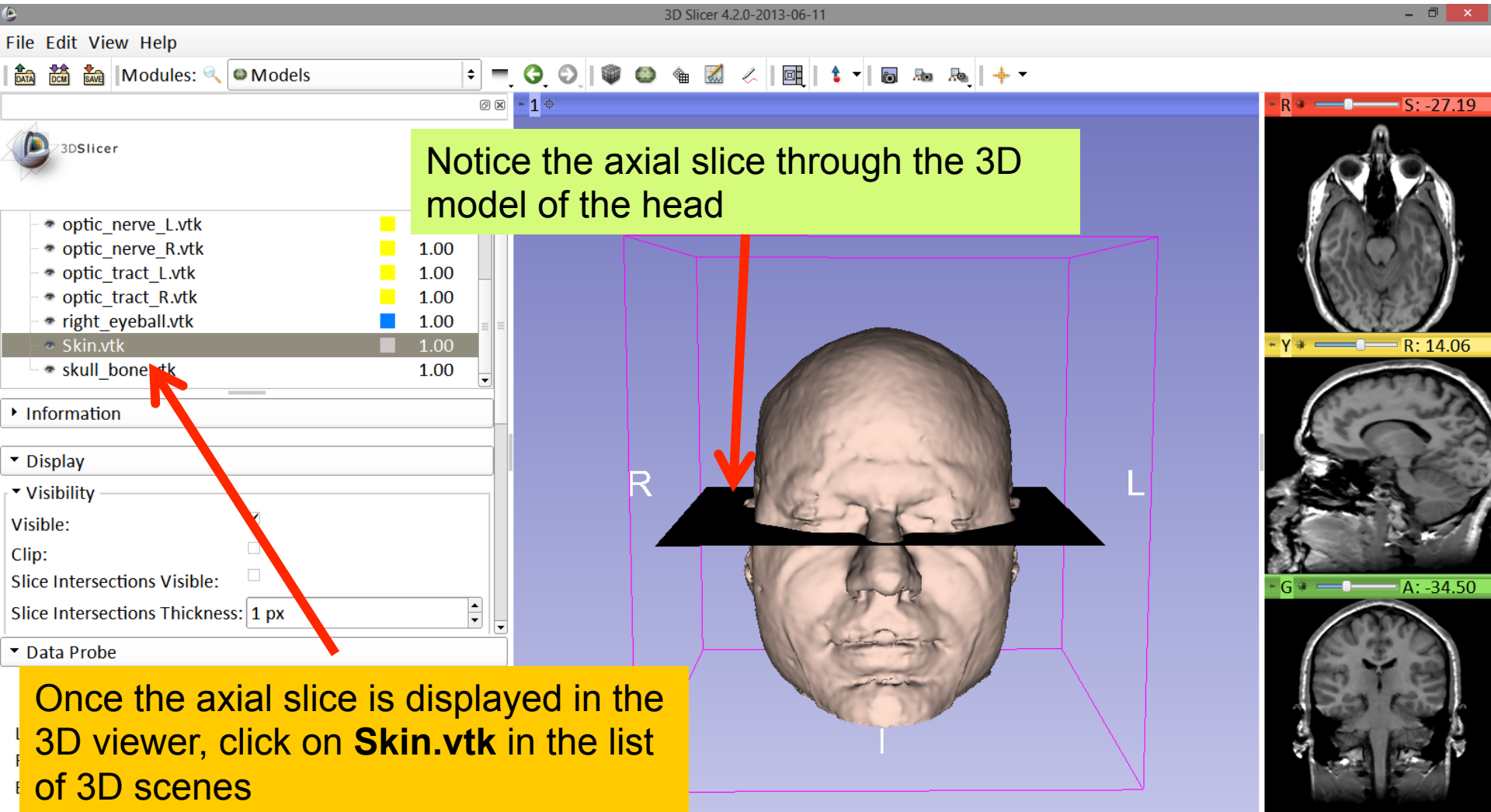
Models Module



3D Visualization



3D Visualization



3D Visualization

File Edit View Help

Modules: Models

3DSlicer

Display

Visibility

Visible: ☒

Clip: ☐

Slice Intersections Visible: ☐

Slice Intersections Thickness: 1 px

Representation

Color

Color: #ffddce

Opacity: 1.00

Edge Visibility: ☐

Edge Color: #000000

Lighting

Material

Scalars

Data Probe

S

R

L

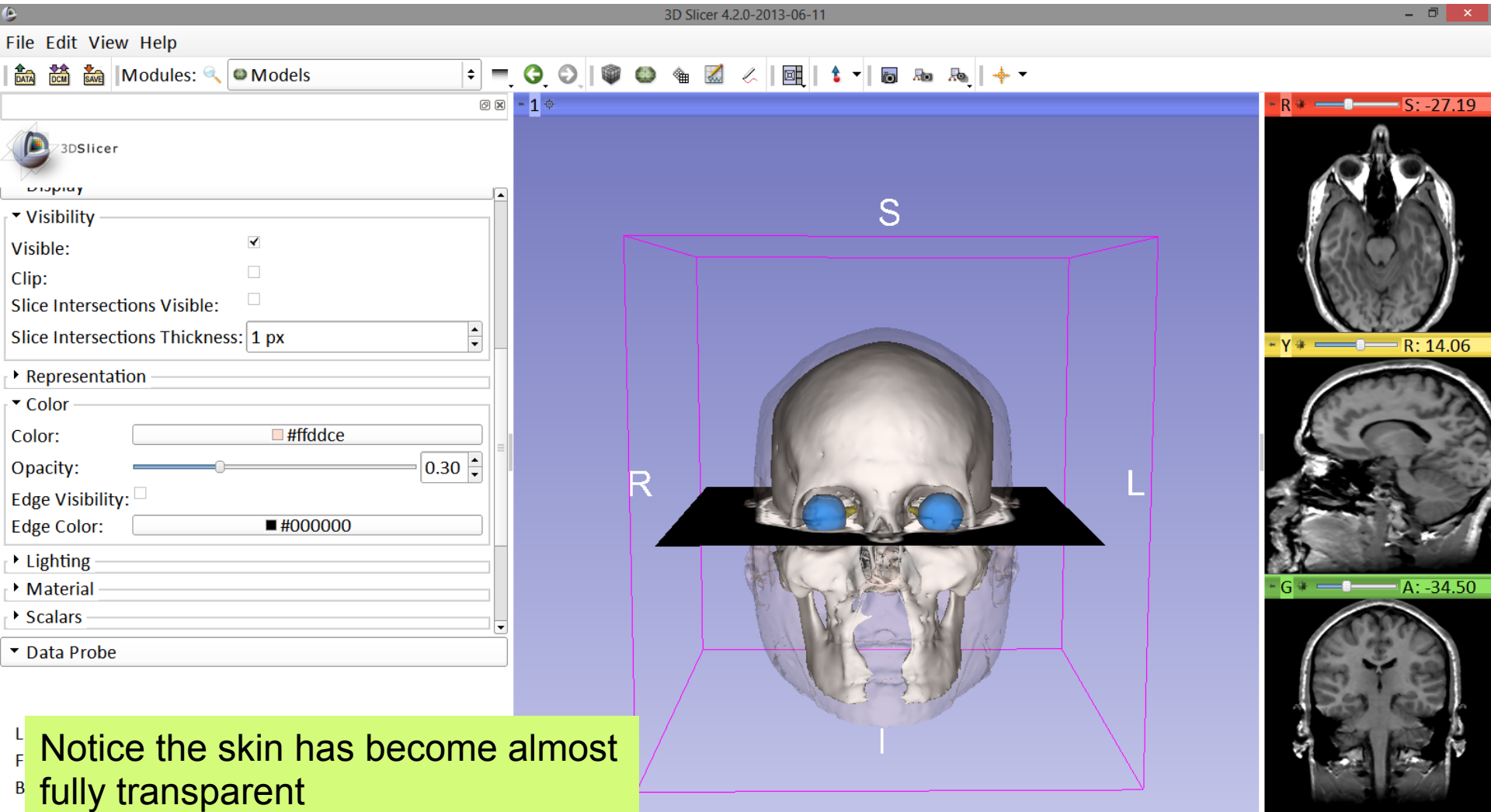
S: -27.19

R: 14.06

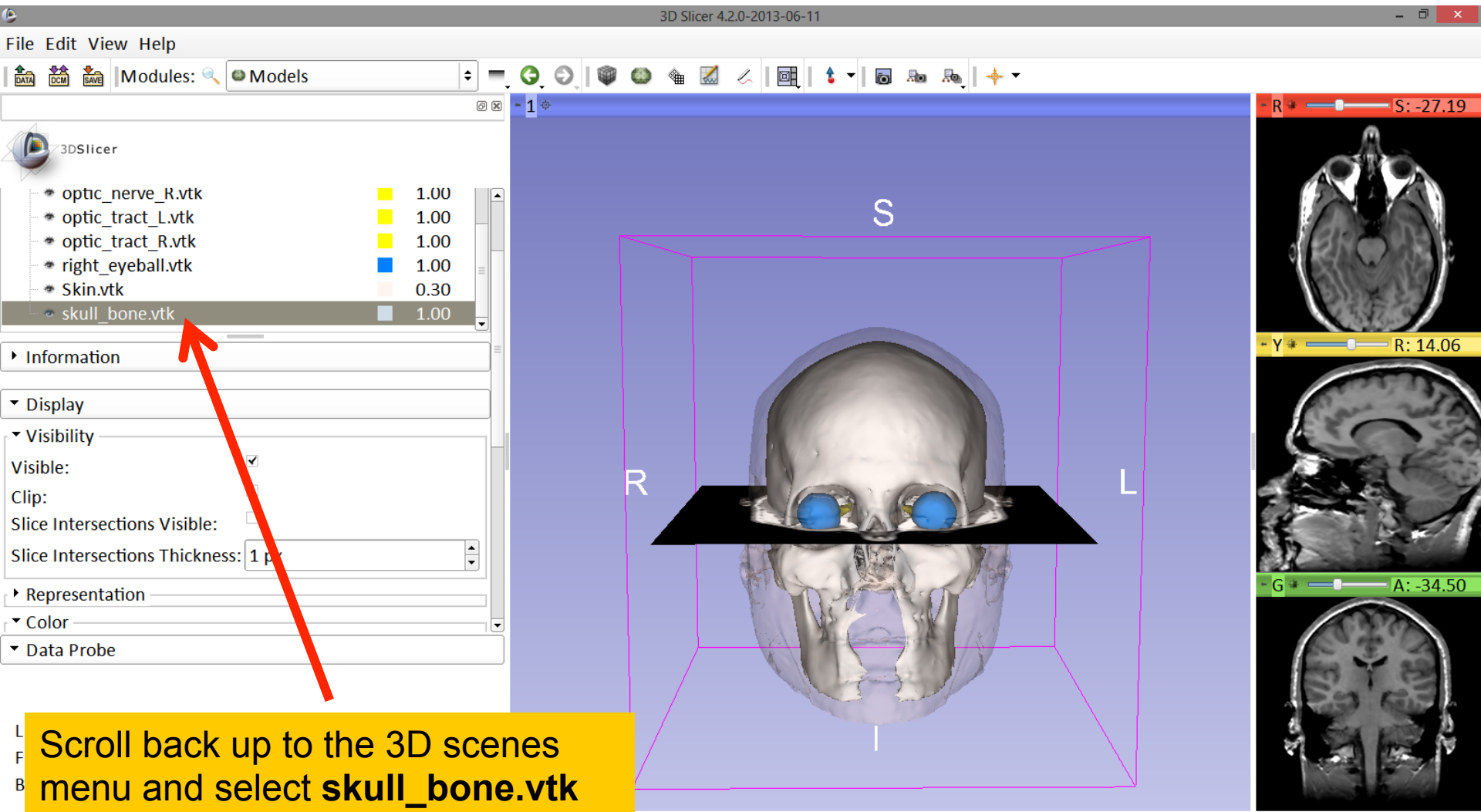
A: -34.50

Scroll down the **Models** tabs and locate the “**Color**” tab. Lower the **Opacity** to a transparent level, around .30

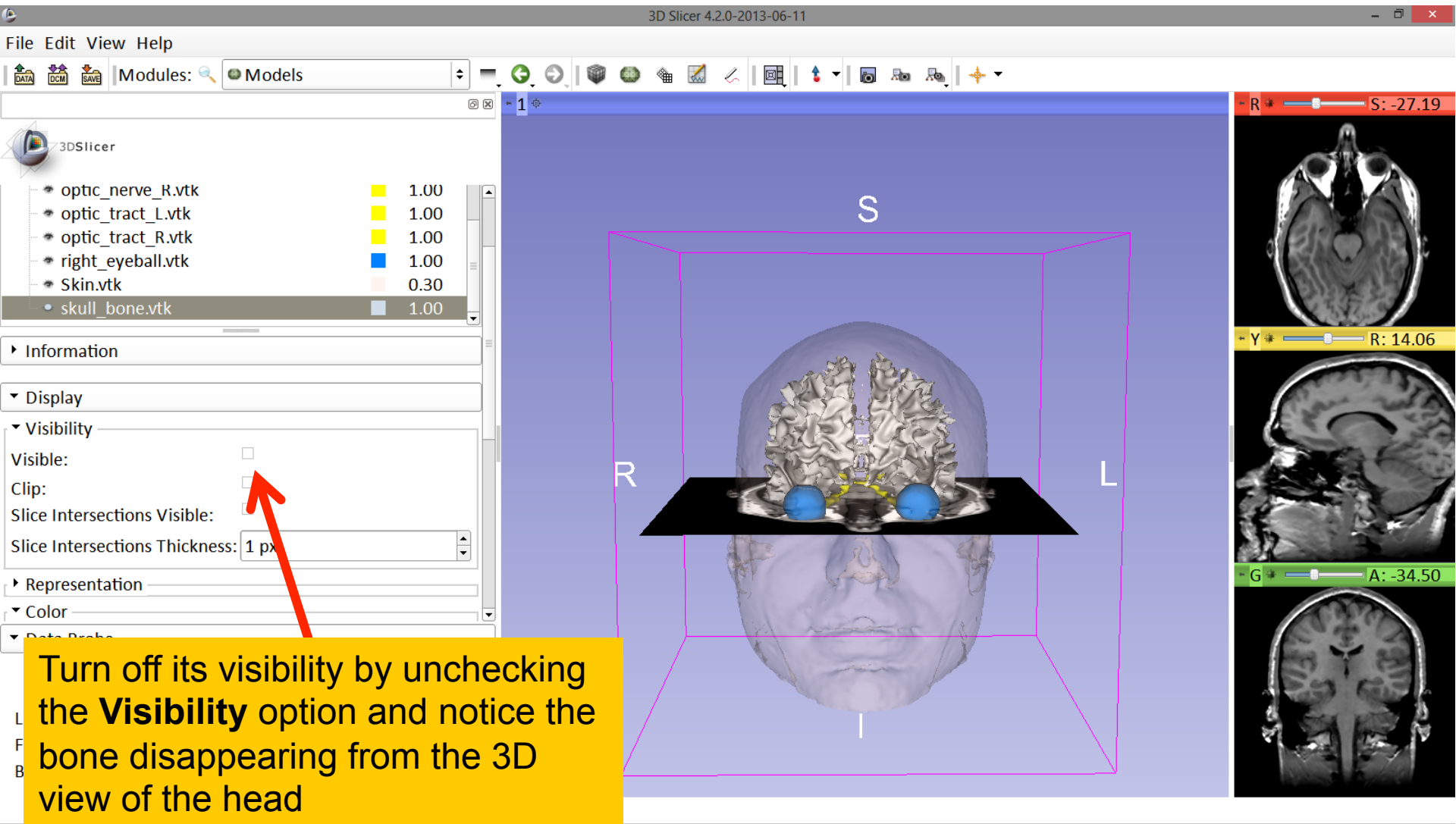
3D Visualization



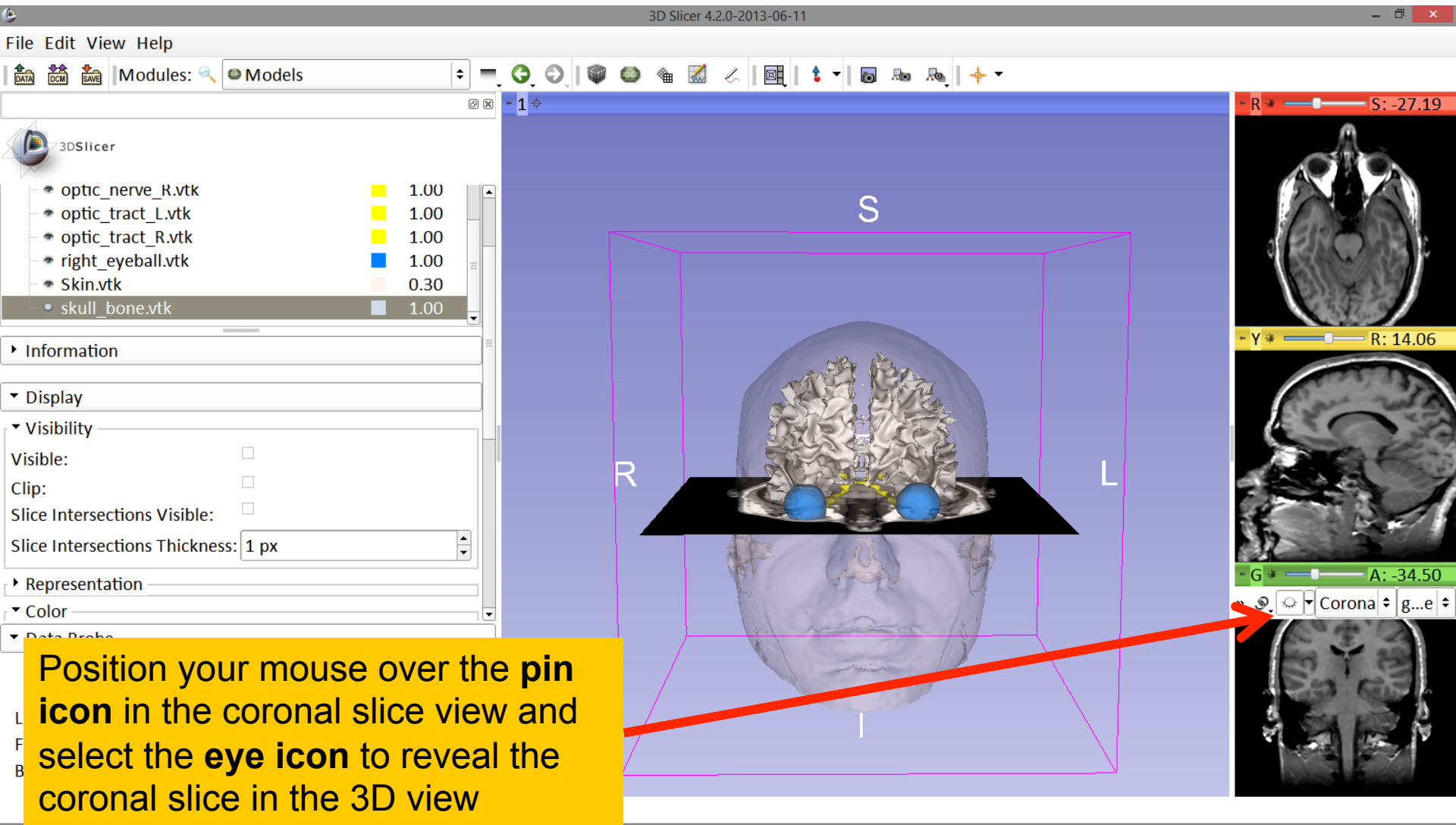
3D Visualization



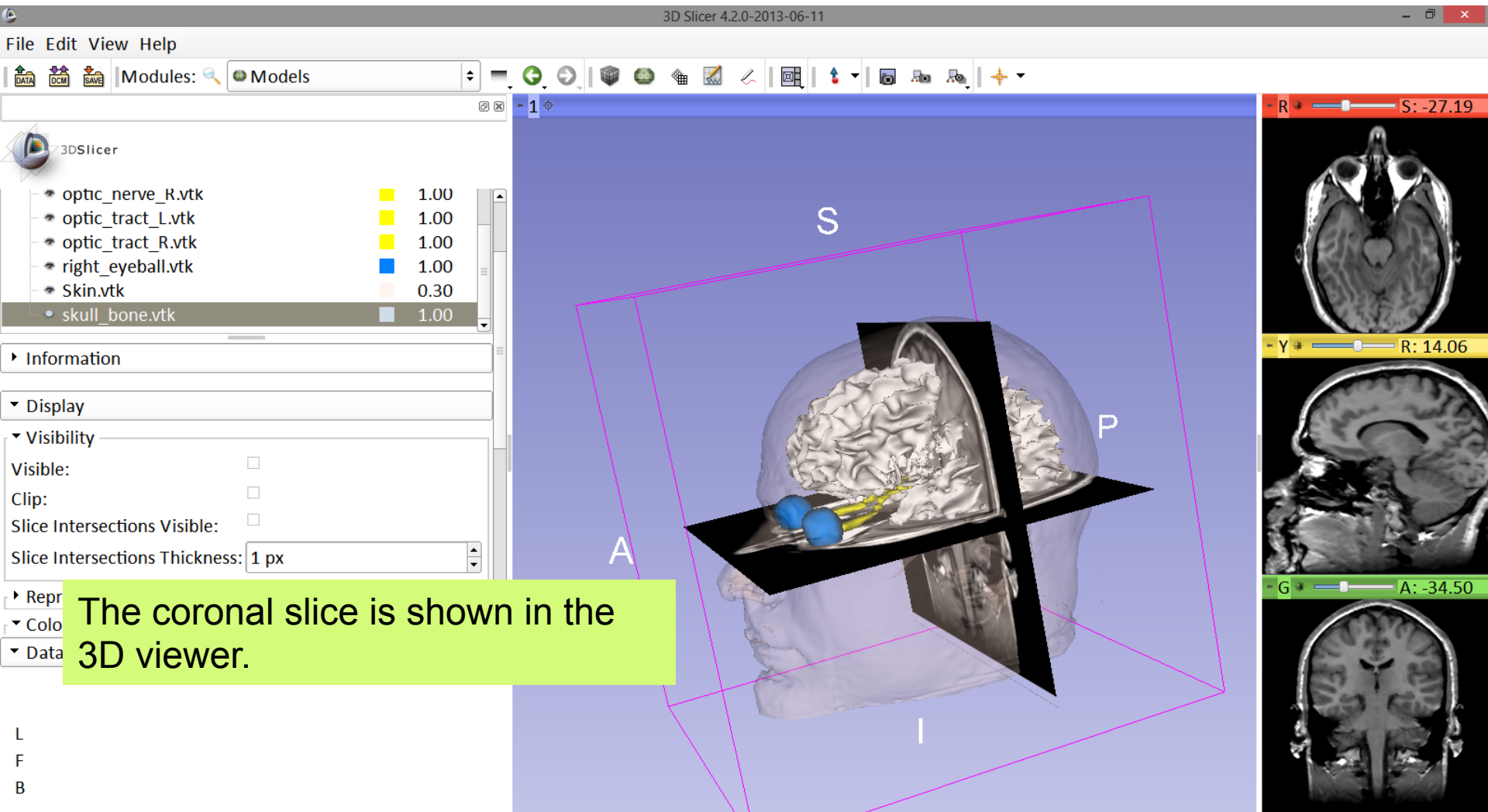
3D Visualization



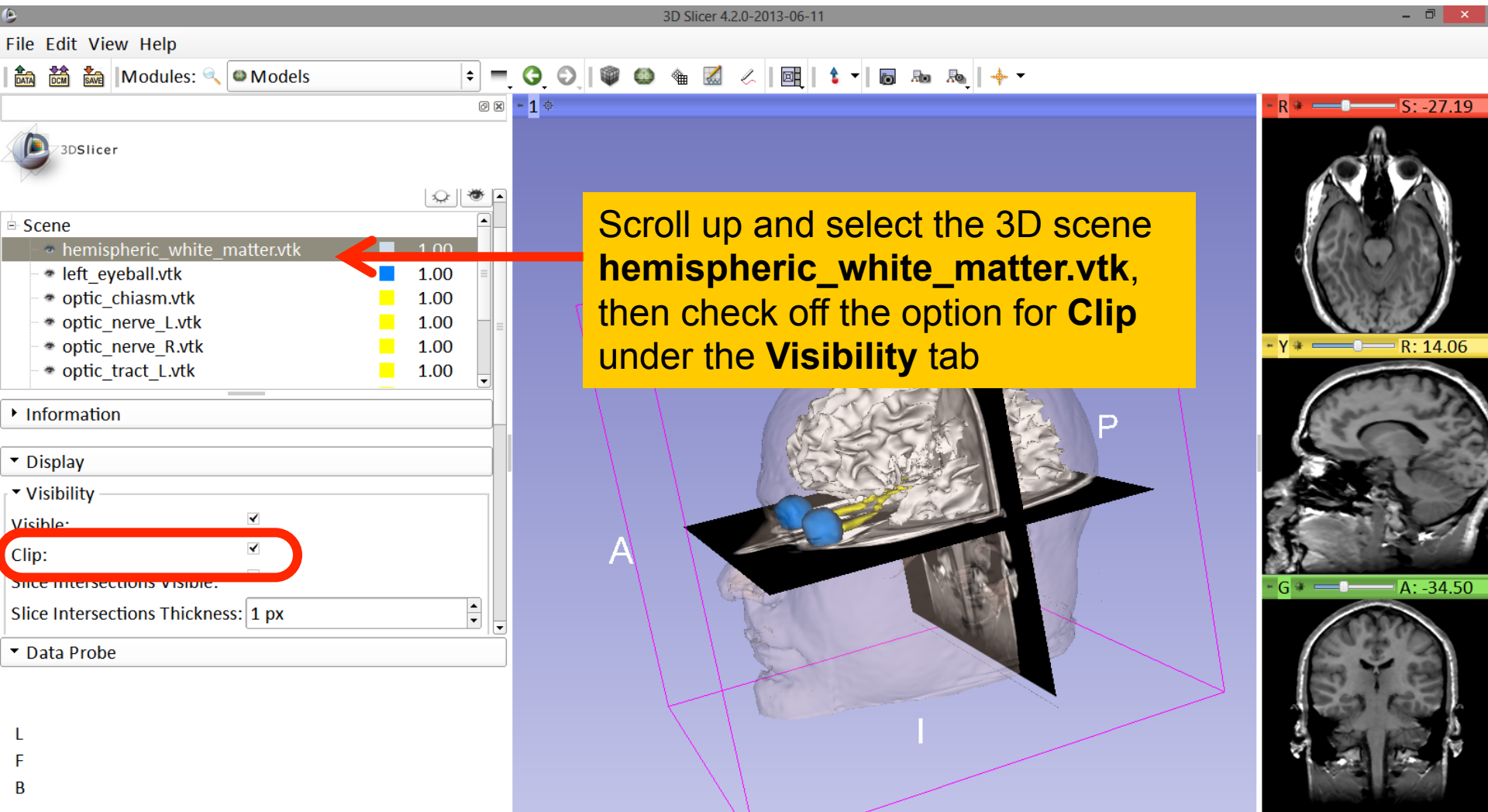
3D Visualization



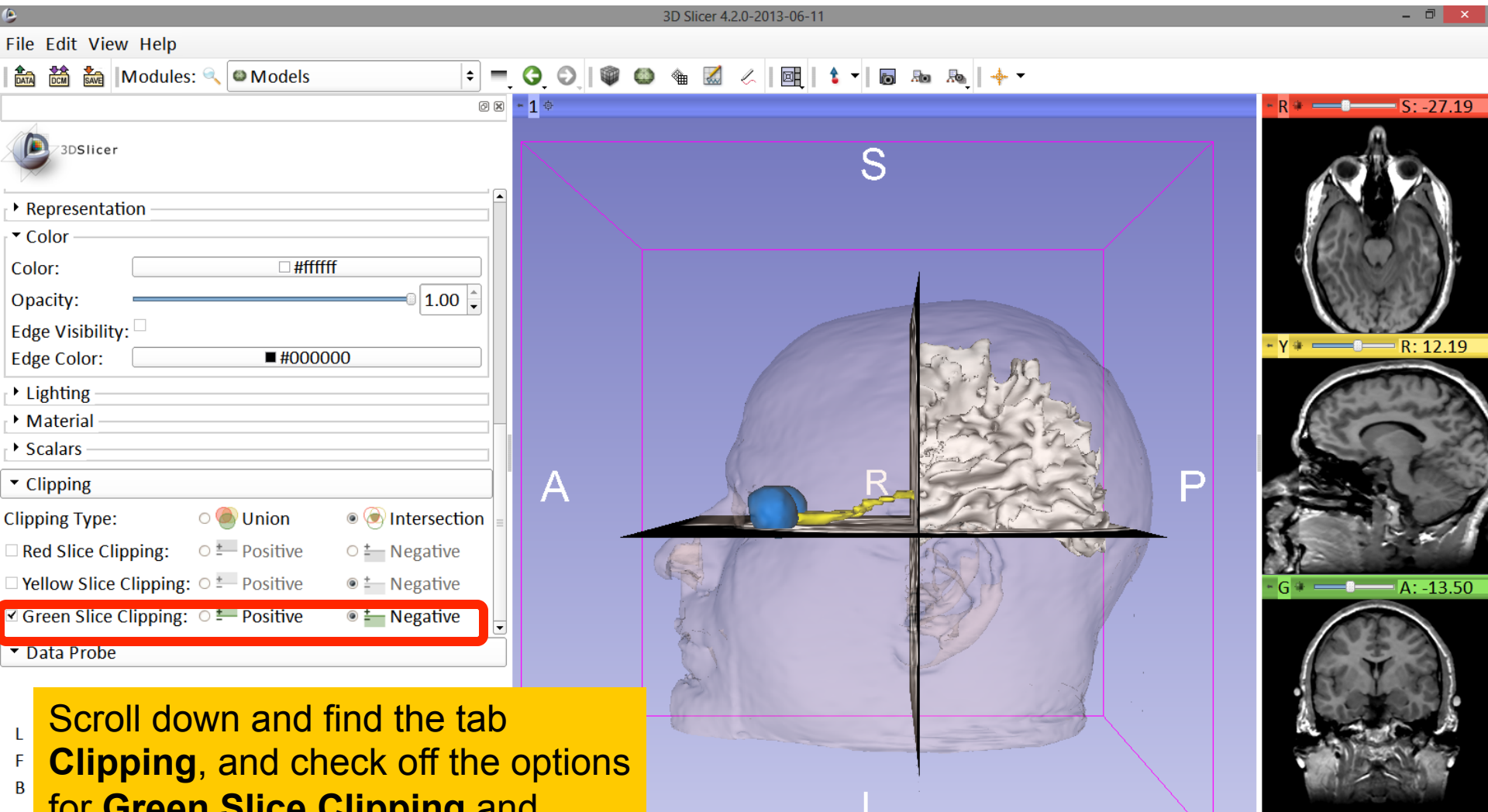
3D Visualization



3D Visualization

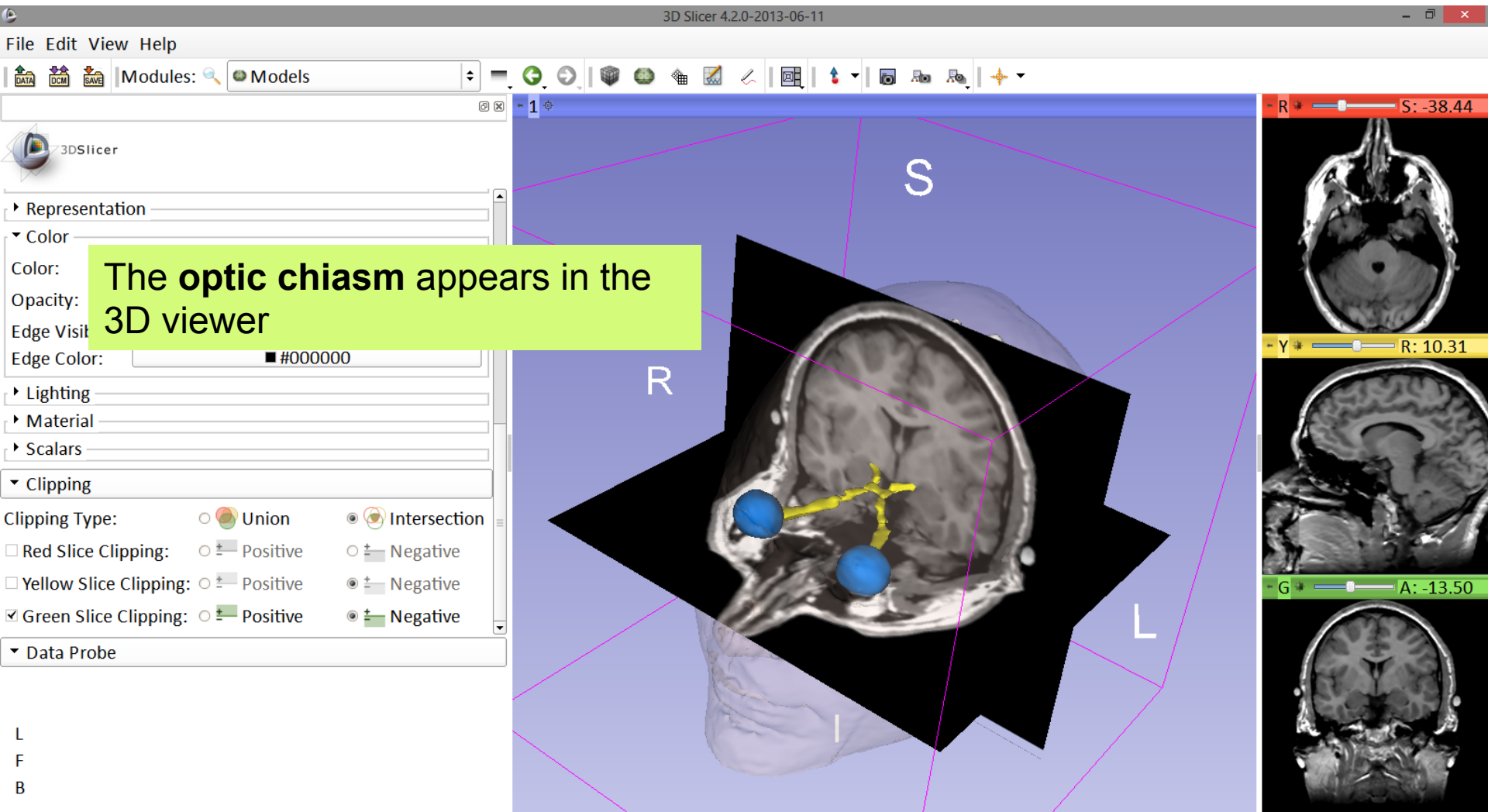


3D Visualization

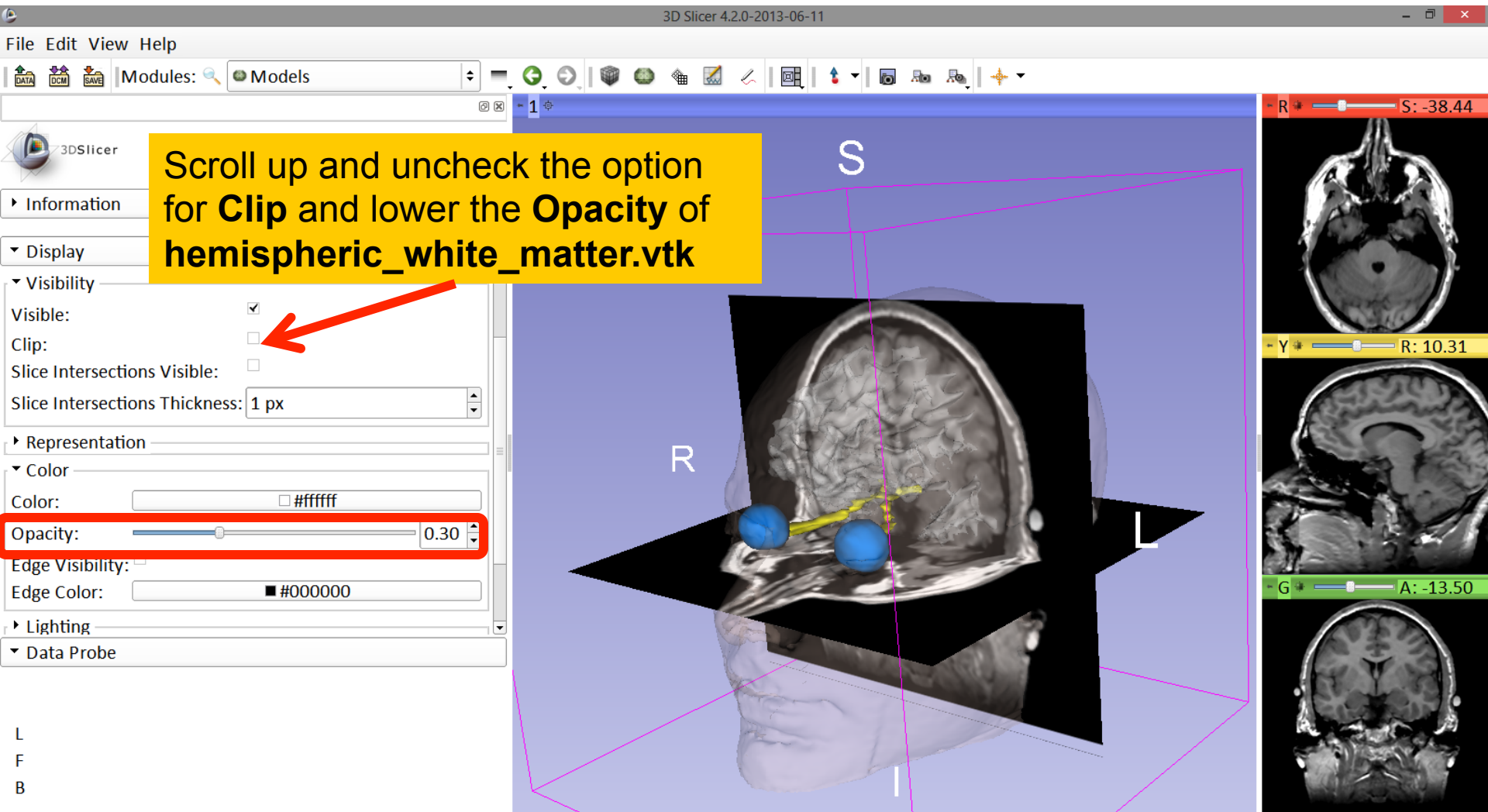


Scroll down and find the tab **Clipping**, and check off the options for **Green Slice Clipping** and **Negative Space**

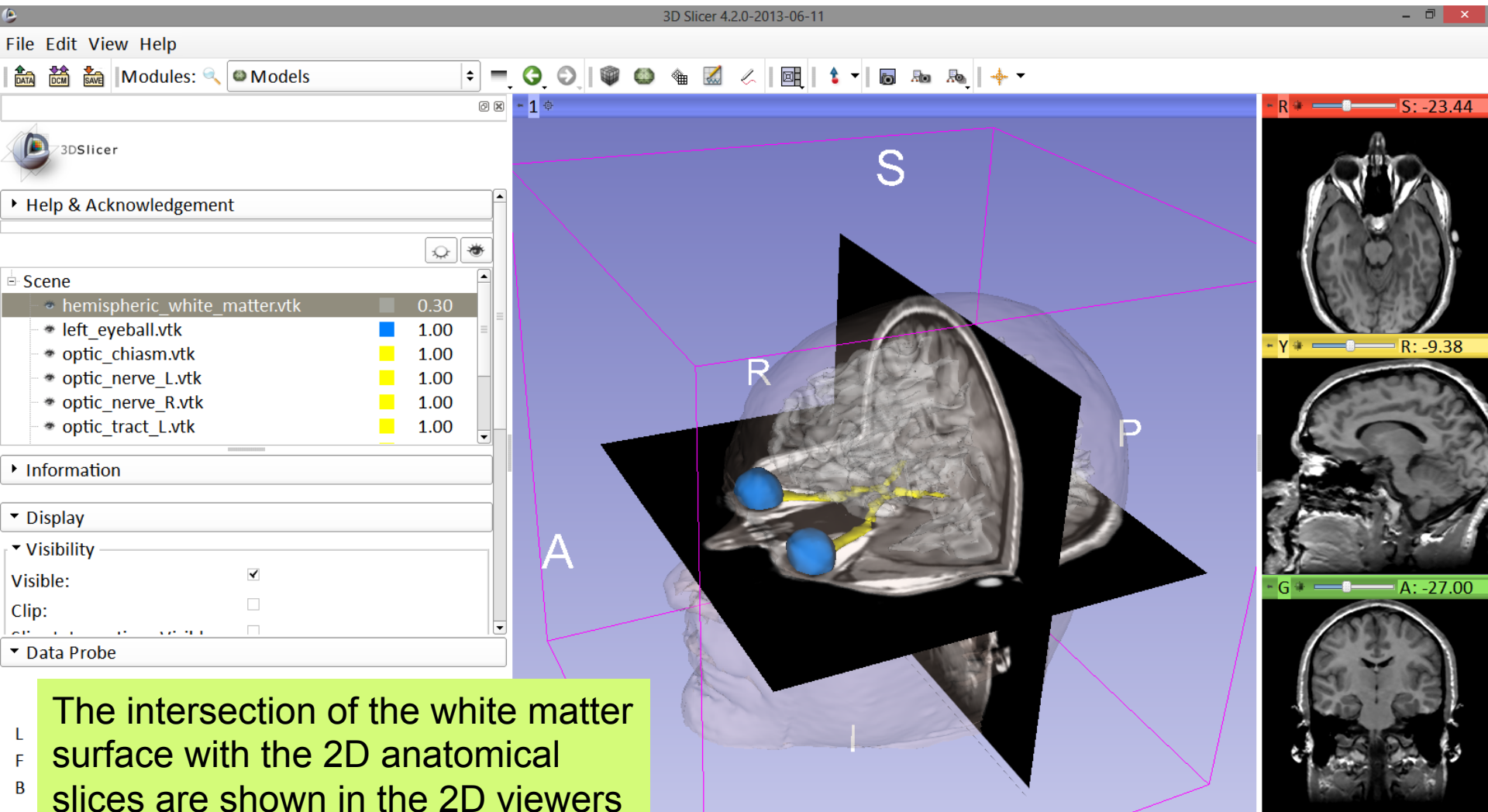
3D Visualization



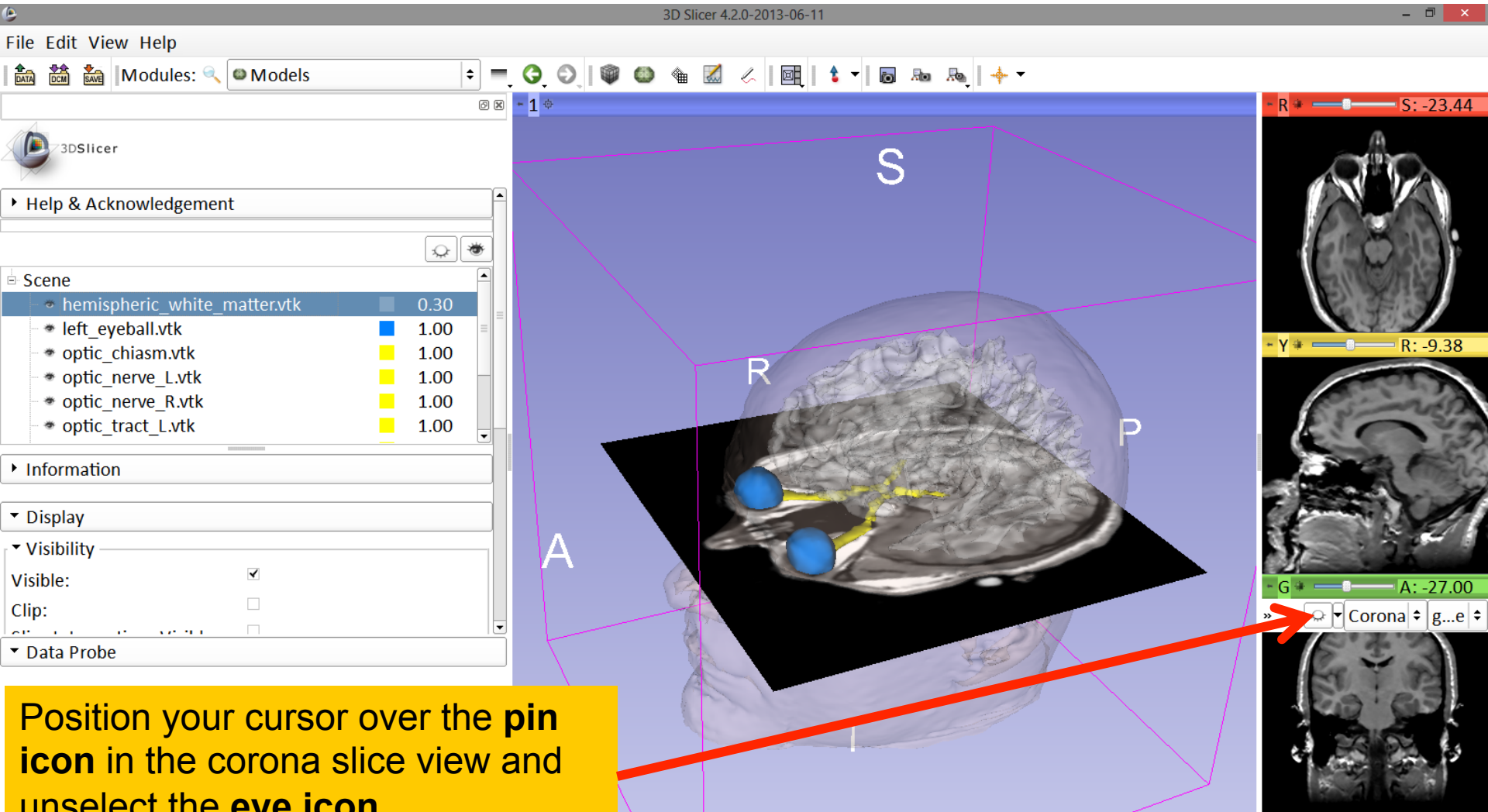
3D Visualization



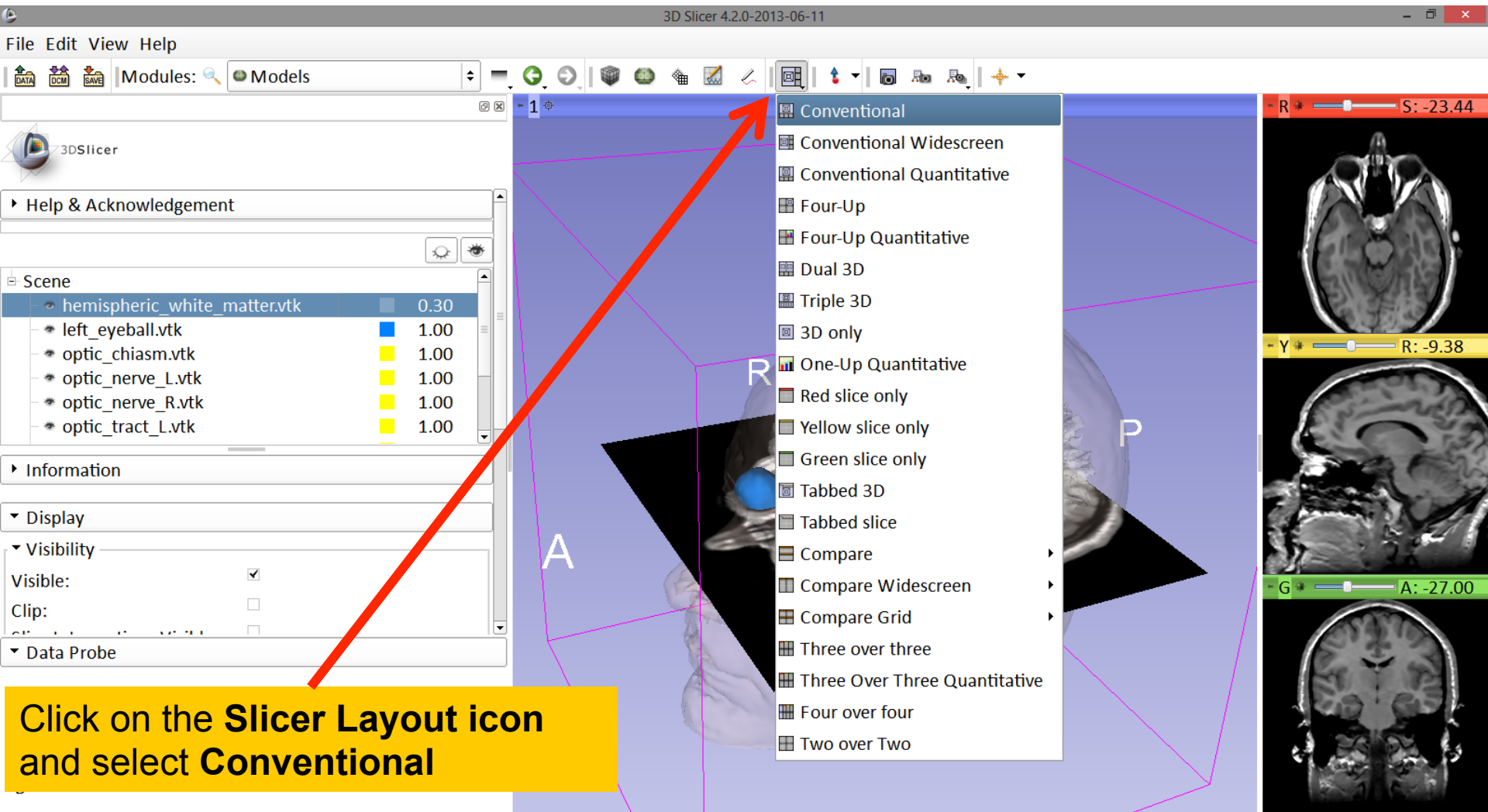
3D Visualization



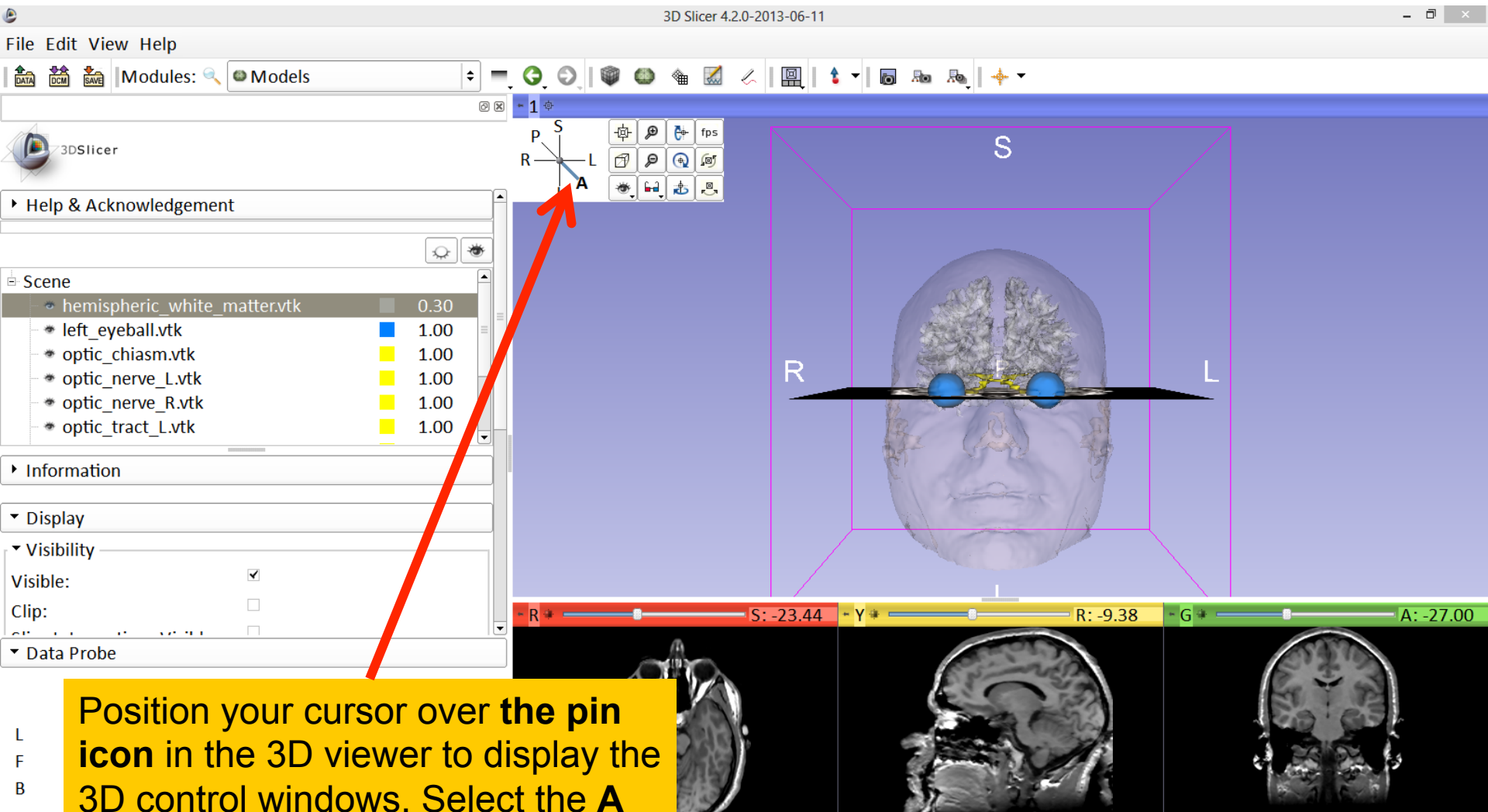
3D Visualization



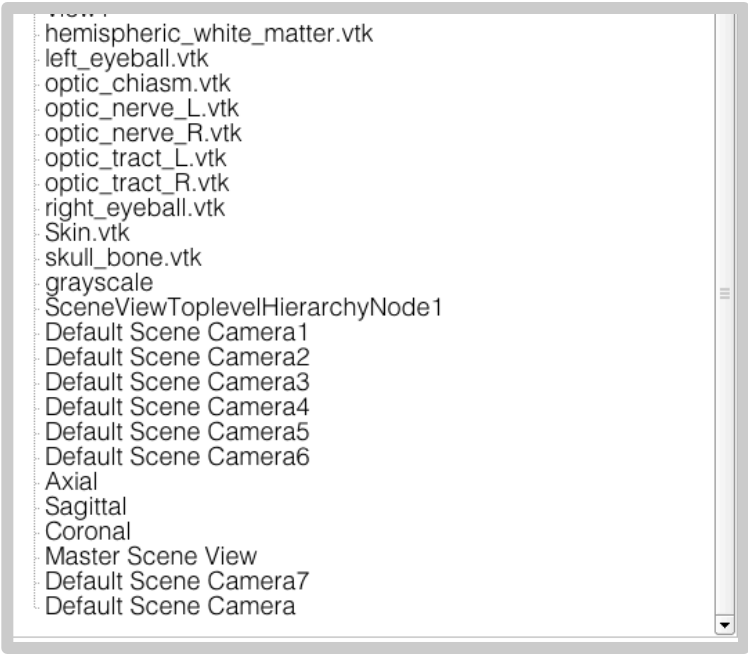
3D Visualization



3D Visualization



Position your cursor over the **pin icon** in the 3D viewer to display the 3D control windows. Select the **A (Anterior)** view of the 3D models



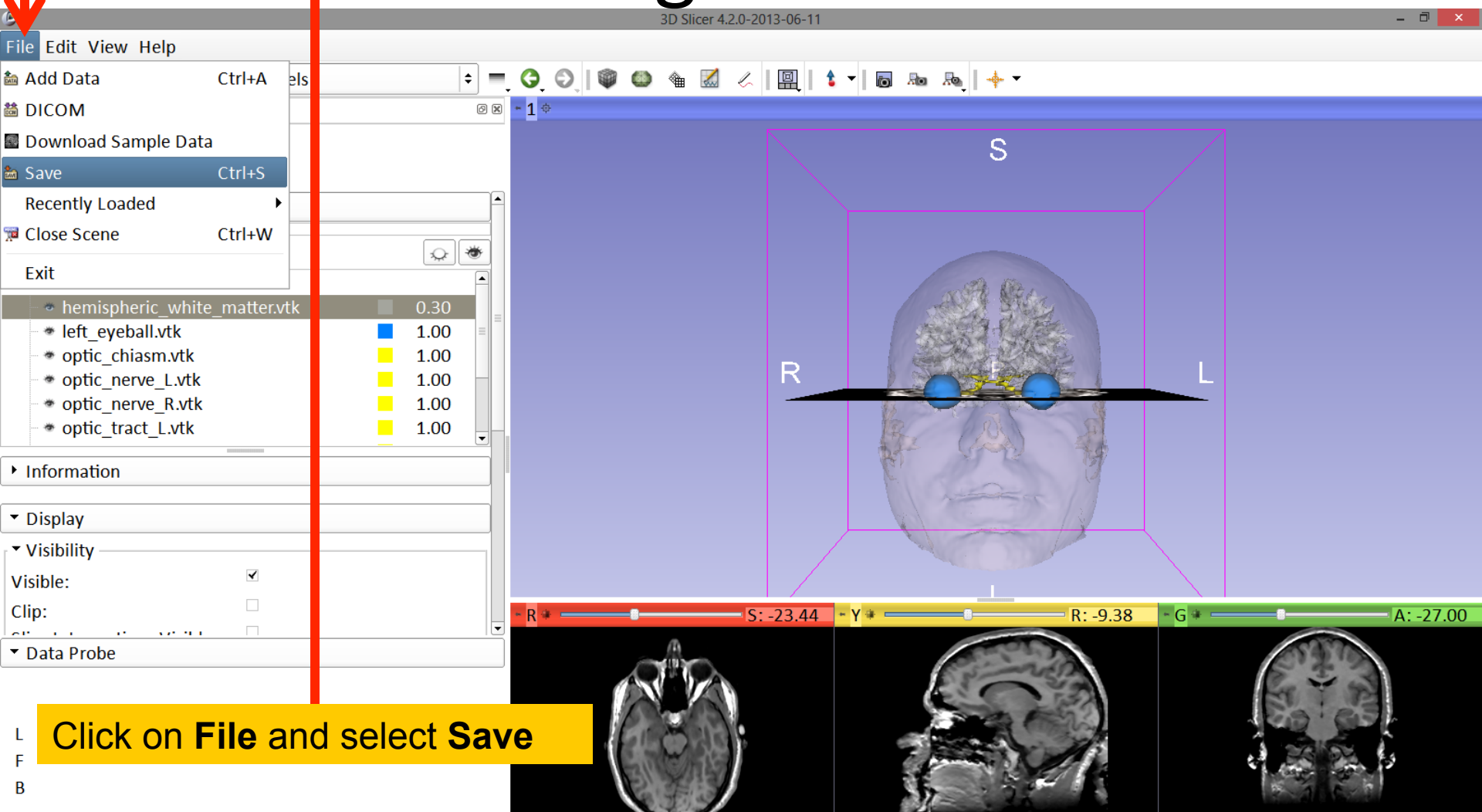
A screenshot of a VTK scene hierarchy window. The window has a title bar and a list of objects. The objects are listed in a hierarchical manner, with some indented. The objects are: hemispheric_white_matter.vtk, left_eyeball.vtk, optic_chiasm.vtk, optic_nerve_L.vtk, optic_nerve_R.vtk, optic_tract_L.vtk, optic_tract_R.vtk, right_eyeball.vtk, Skin.vtk, skull_bone.vtk, grayscale, SceneViewToplevelHierarchyNode1, Default Scene Camera1, Default Scene Camera2, Default Scene Camera3, Default Scene Camera4, Default Scene Camera5, Default Scene Camera6, Axial, Sagittal, Coronal, Master Scene View, Default Scene Camera7, and Default Scene Camera. The window has a scrollbar on the right side.

```
hemispheric_white_matter.vtk
left_eyeball.vtk
optic_chiasm.vtk
optic_nerve_L.vtk
optic_nerve_R.vtk
optic_tract_L.vtk
optic_tract_R.vtk
right_eyeball.vtk
Skin.vtk
skull_bone.vtk
grayscale
SceneViewToplevelHierarchyNode1
  Default Scene Camera1
  Default Scene Camera2
  Default Scene Camera3
  Default Scene Camera4
  Default Scene Camera5
  Default Scene Camera6
  Axial
  Sagittal
  Coronal
  Master Scene View
  Default Scene Camera7
  Default Scene Camera
```

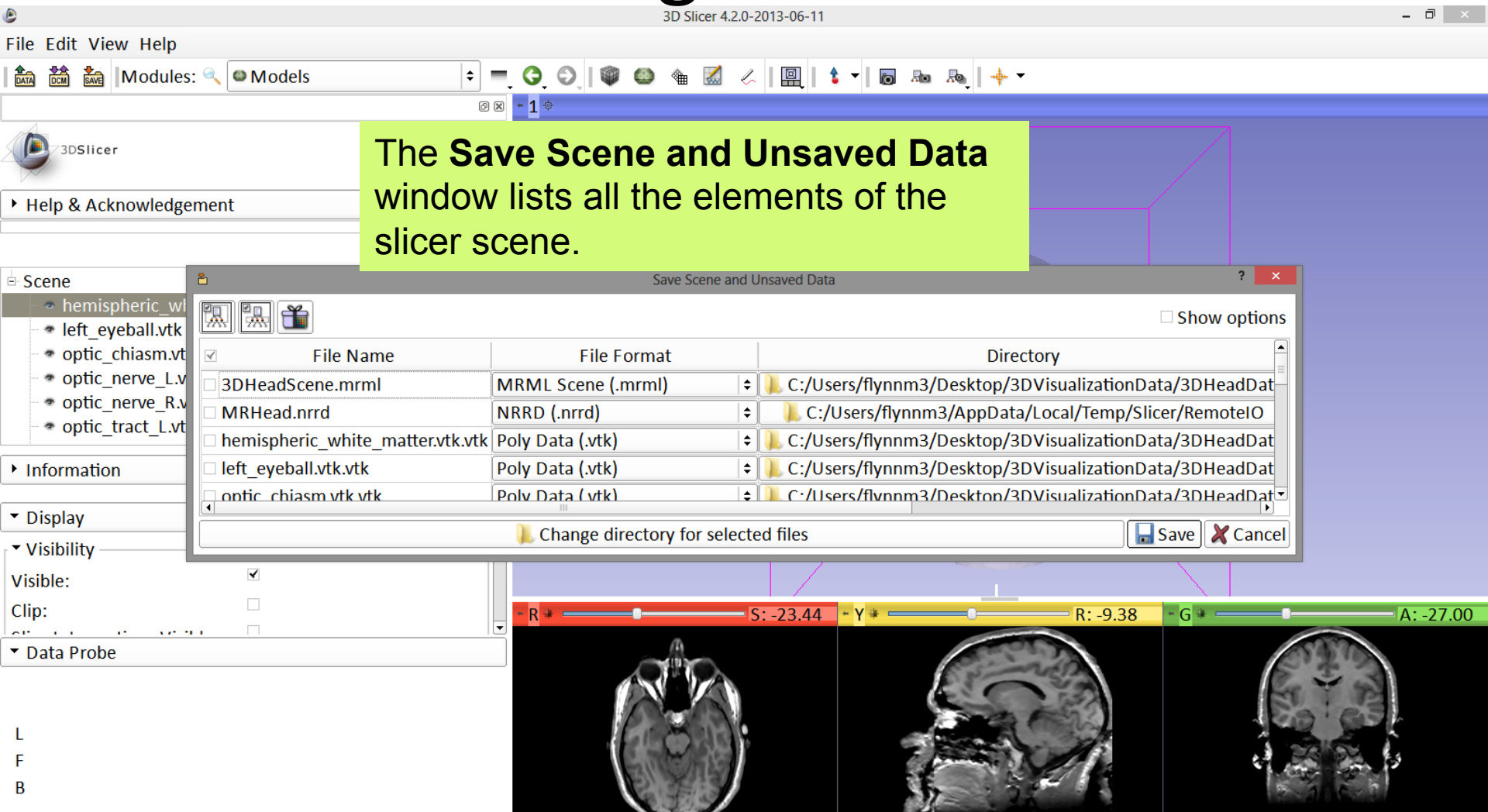
Part 3:

Saving a scene

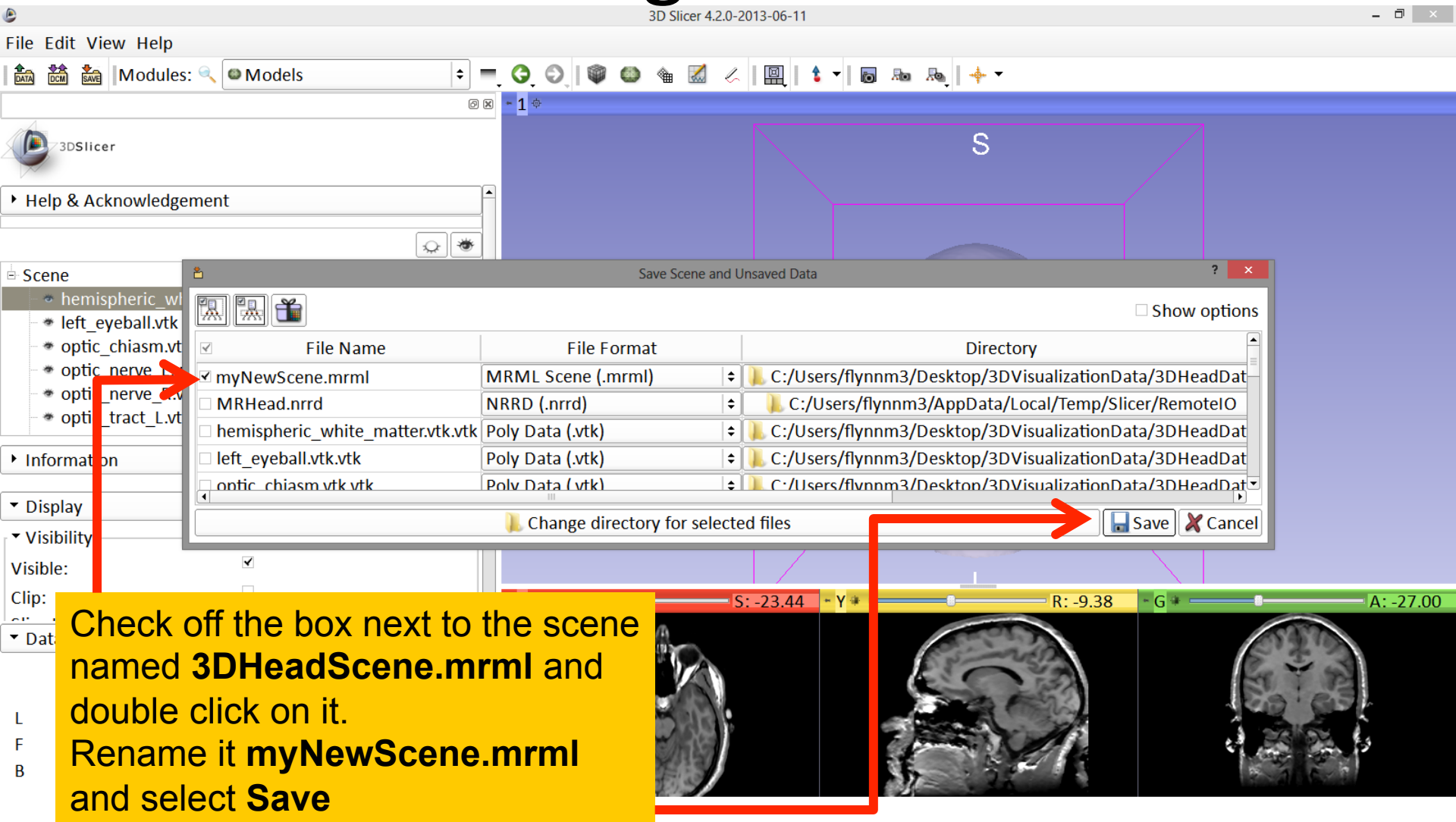
Saving a Scene



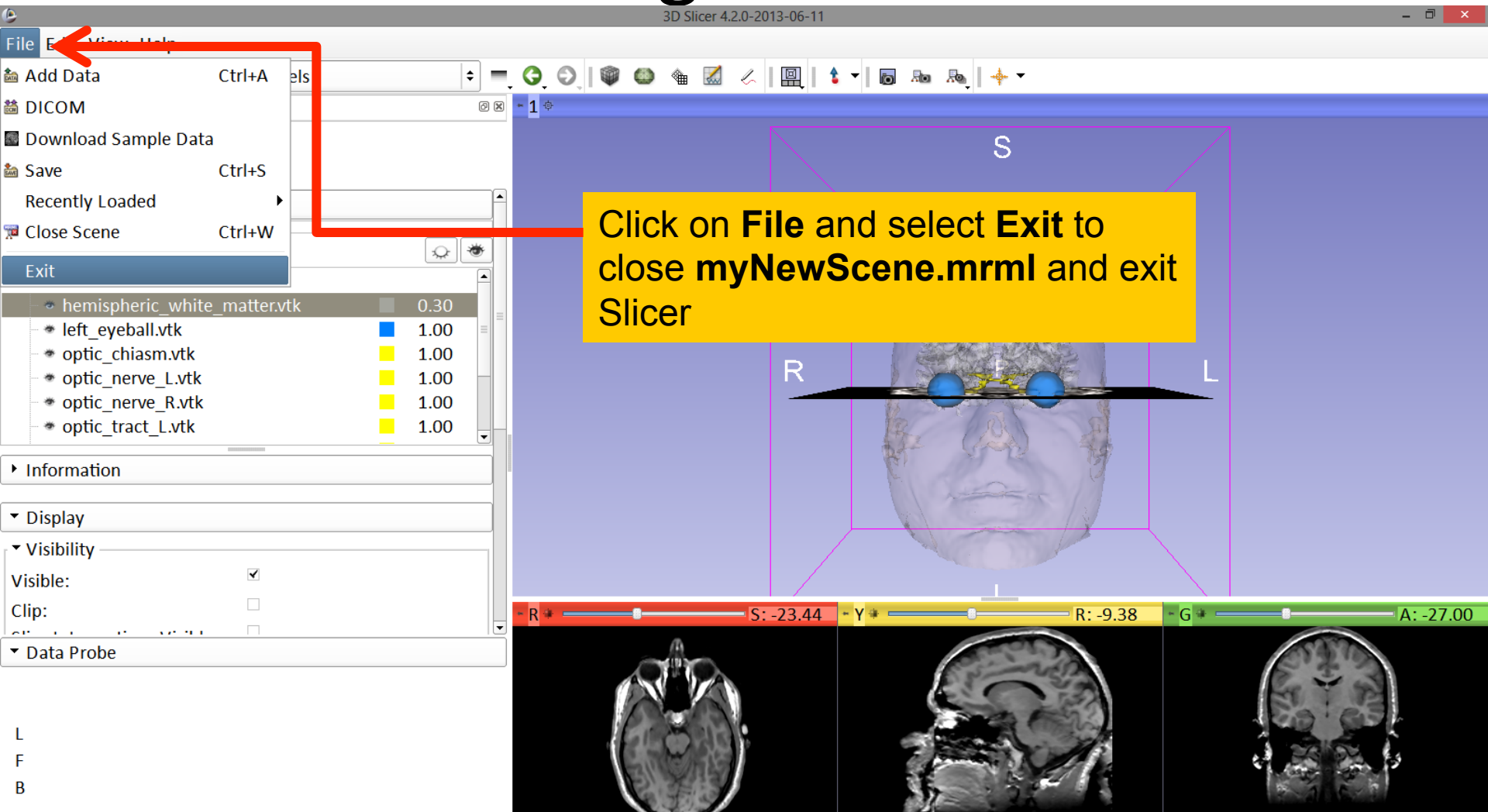
Saving a Scene



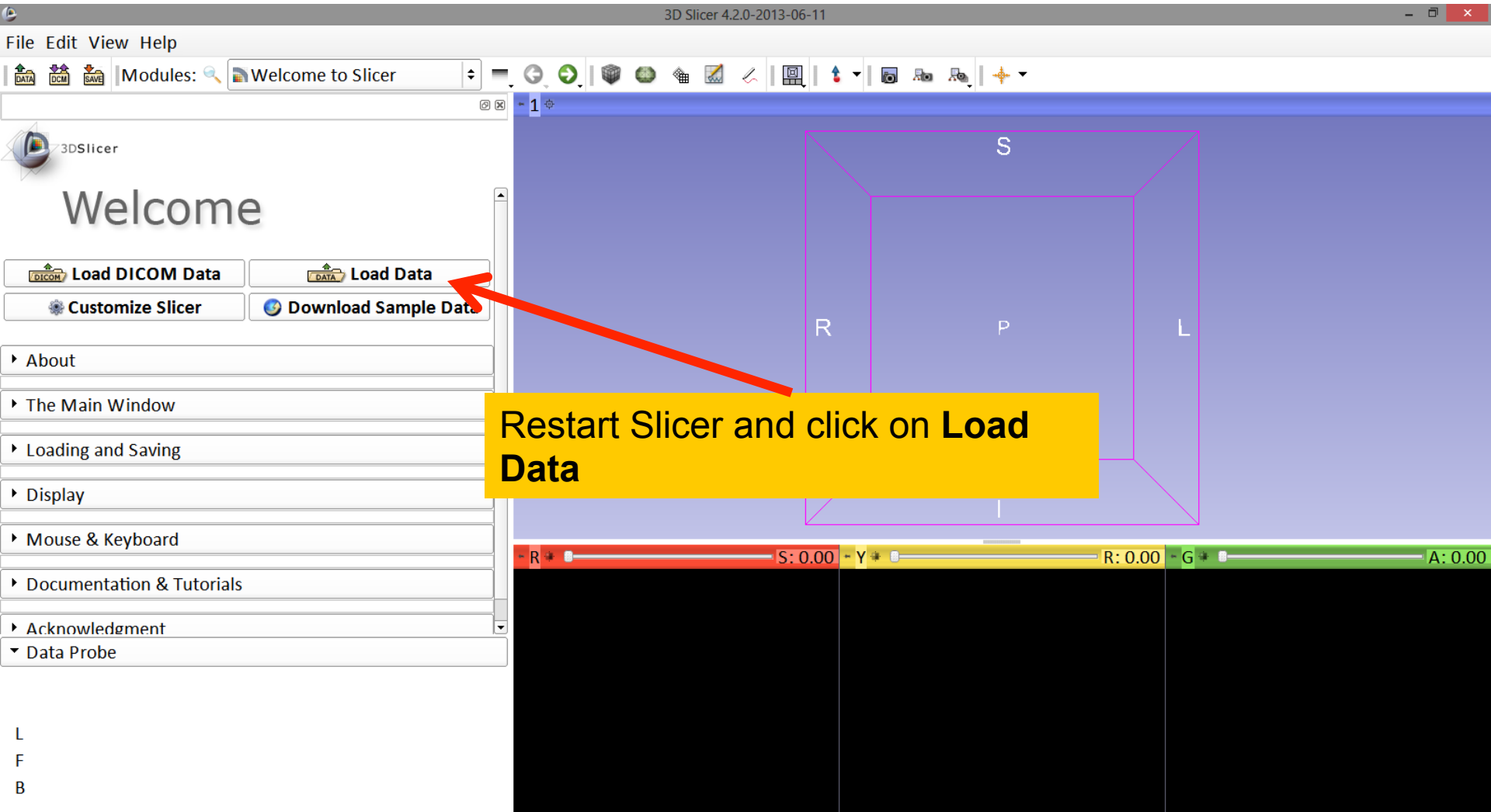
Saving a Scene



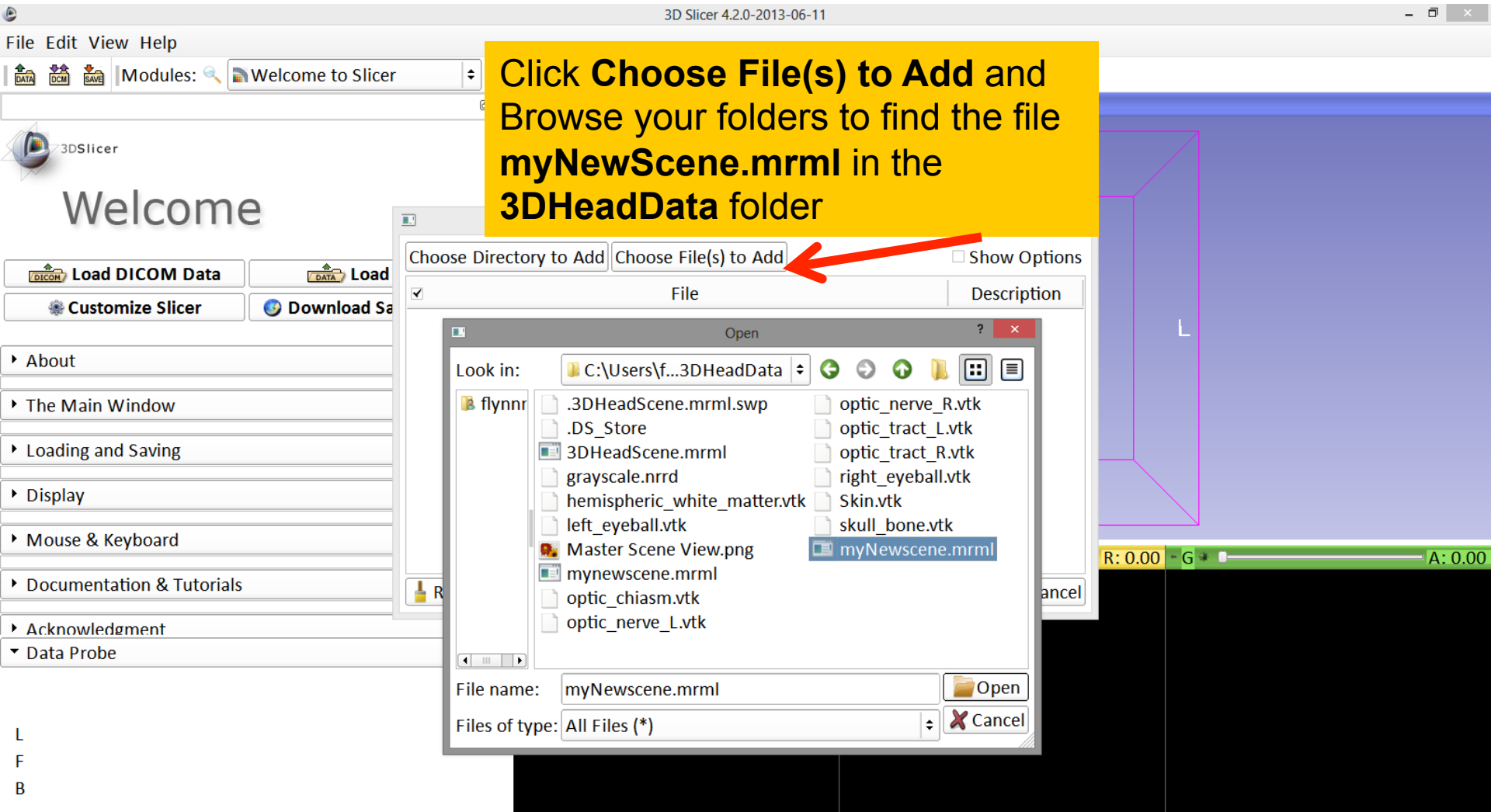
Saving a Scene



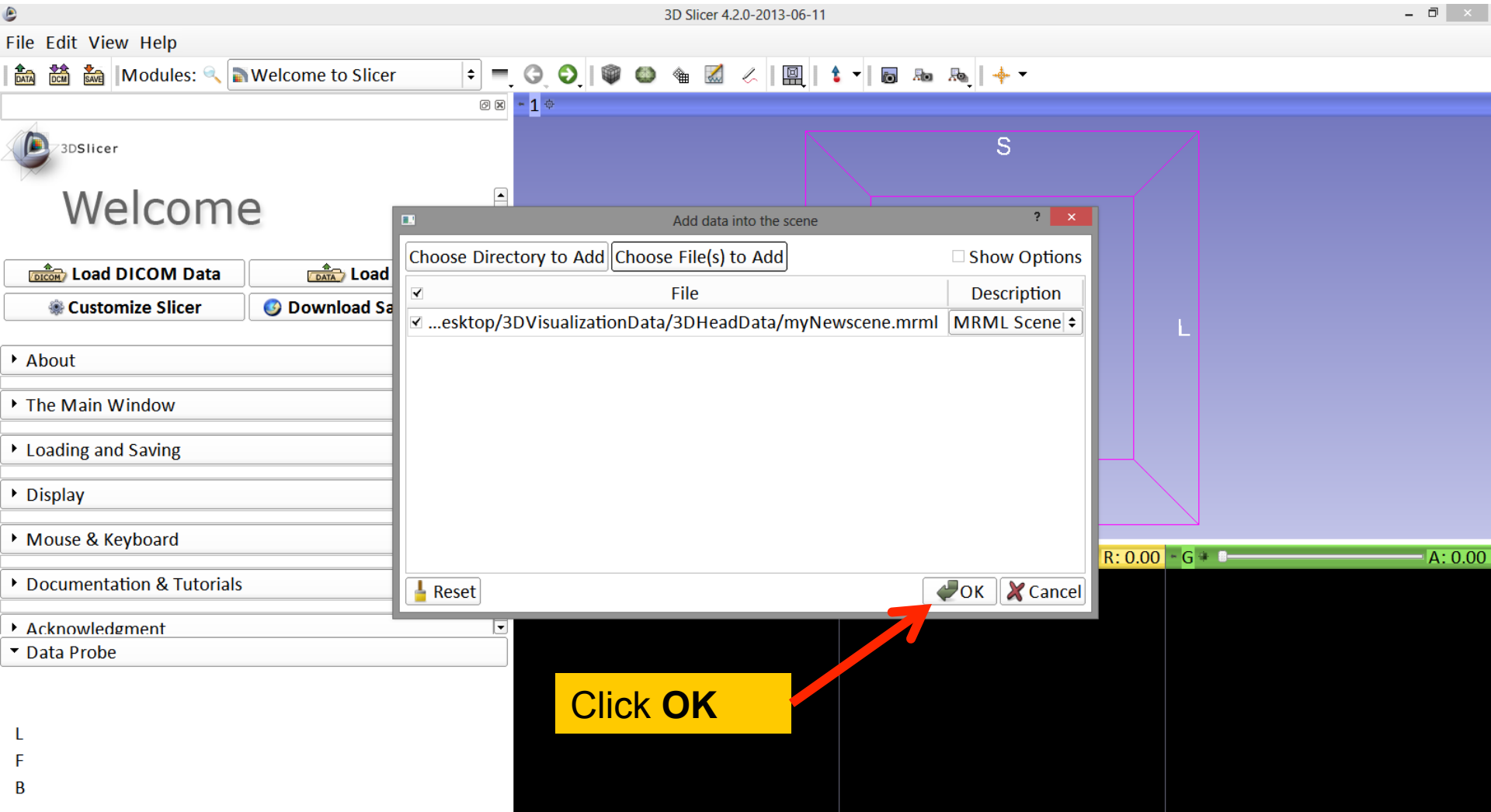
Scene Restore



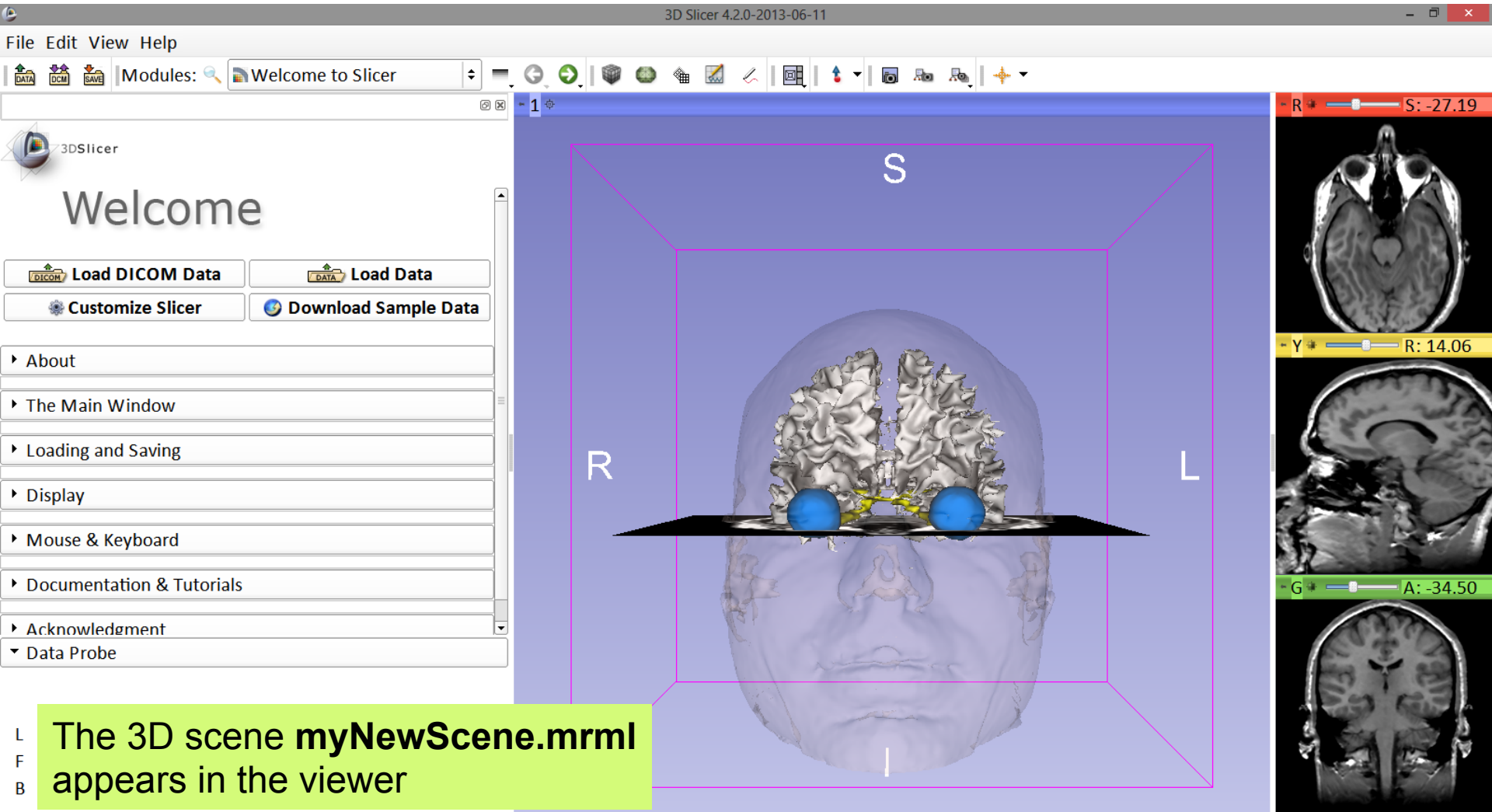
Scene Restore



Scene Restore



Slicer4



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NIH U54EB005149



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